The Pliocene Gastropoda (Mollusca) of Estepona, southern Spain. Part 13: Murchisonelloidea and Pyramidelloidea

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In this paper we review the Murchisonelloidea and Pyramidelloidea of the lower Piacenzian, upper Pliocene of Estepona, southern Spain. The same groups from the roughly contemporaneous Atlantic assemblage of the Mondego Basin, central-west Portugal have also been reviewed and included in the distribution data, but not figured. Six species of Murchisonelloidea are recorded, representing three genera, of which none are new. Pyramidelloidea are represented by 38 genera, of which two are new *Lafolletteia* nov. gen. and *Mulderia* nov. gen., and 178 species, of which 15 are new: *Liostomia wilvanderstoelae* nov. sp., *Odostomia malagensis* nov. sp., *Ondina pinguis* nov. sp., *Mulderia mulderi* nov. sp., *Pyrgulina marliesae* nov. sp., *Chemnitzia silvai* nov. sp., *Pyrgiscus jaapmulderi* nov. sp., *Turbonilla bincki* nov. sp., *Turbonilla bongiardinoi* nov. sp., *Turbonilla crovatoi* nov. sp., *Turbonilla malacitana* nov. sp., *Turbonilla mauroi* nov. sp., *Turbonilla plioalboranensis* nov. sp., *Turbonilla velerinensis* nov. sp., and *Eulimella ariejansseni* nov. sp. whilst 16 species are left in open nomenclature.
The following are new synonymies: *Parthenina semiornata* Cerulli-Irelli, 1914 is considered a junior subjective synonym of *Parthenina decussata* (Montagu, 1803), *Parthenina incerta* Milaschewitsch, 1916 is considered a junior subjective synonym of *Spiralina alpinoligustica* (Sacco, 1892), the genus *Salassiella* Dall & Bartsch, 1909 is considered a junior subjective synonym of *Trabecula* Monterosato, 1884
Pyrgulina (*Parthenina*) *dollfusi* Cossmann 1921 is a junior homonym of *Parthenia dollfusi* Kobelt, 1903 and is renamed *Parthenina pacaudi* nom. nov.

Key words: southern Spain, upper Pliocene, Gastropoda, Murchisonelloidea, Pyramidelloidea, new genus, new species

Introduction

The Pliocene assemblage of Estepona in south-western Spain is probably the most diverse Pliocene molluscan assemblage in Europe. With this revision, previous estimates of about 800 gastropod species (Landau & Mulder, 2020, p 26) are too low, and the number is likely to be closer to 1000. In this paper we review the superfamilies Murchisonelloidea Casey, 1904 and Pyramidelloidea Gray, 1840 and record 184 species representing 41 genera.
This is the most diverse Pliocene pyramidellid assemblage since Sacco's (1892a, 1892b) monographs on the Italian Neogene deposits. Despite this enormous diversity, this work is by no means exhaustive. Many specimens, especially belonging to the subfamily Odostomiinae Pelseneer, 1928 cannot be ascribed with certainty to any known species and have not been illustrated or included. They remain in open nomenclature in the NHMW collections. It is quite possible that these specimens represent undescribed species. However whilst the intraspecific variability of most European species is well understood thanks to numerous modern works on the group (*e.g.*, Van Aartsen, 1977, 1981, 1984, 1987, 1994; Van Aartsen & Menkhorst 1996; Van Aartsen *et al*., 1984; Fretter *et al*., 1986; Giannuzzi-Savelli *et al*., 2014; Høisaeter, 2014; Micali, 1985a, 1985b, 1994; Micali *et al*., 1993, 2015; Peñas *et al*., 1996, *inter alia*), many species have been described relatively recently from West Africa (*e.g.*, Peñas & Rolán, 1997, 1998, 1999a, 2000, 2001a, 2001b, 2002; Peñas *et al*., 2014; Van Aartsen *et al*., 1998, 2000; Schander, 1994, *inter alia*) based on few specimens, or including few photographs, making their intraspecific variability unknown. It is possible that some of the unidentified Estepona material fits within the variability of these recently described West African species. In this paper, only species that are clearly distinct have been described as new and we have kept the specimens we cannot identify for further study.

Age of the deposits

Prior to 2013 (Landau & Marquet, 2000, 2001; Landau & Lozouet, 2003; Landau *et al*., 2003, 2004a, 2004b, 2006a, 2006b, 2006c, 2007, 2009; Landau & Fehse, 2004; Landau & Silva, 2006a, b) the age of the deposits was stated as upper Zanclean (upper lower Pliocene) following Guerra Merchán *et al*. (2002). In our later works (Landau & Janssen, 2015a, 2015b Landau *et al*., 2015; Landau & Mulder, 2020) we have dated the assemblages as lowest Piacenzian, lower upper Pliocene, an age corroborated by the assemblage of Euthecosomata (Janssen, 2004). Either way, they form part of the Mediterranean ecostratigraphic unit MPPMU1 of Monegatti & Raffi (2001), which includes the Zanclean and lowest Piacenzian (see Landau *et al*., 2011, text-fig. 9).

In this work we have also taken the opportunity to register material in the NHMW collections collected by the first author (BL) between 1990 and 2019 from the Vale de Freixo site located in west-central Portugal (Pombal region) with the geographical coordinates 39°53'02.1"N, 8°43'52.9"W (see Silva *et al*., 2010, fig. 1). This is one of the few Pliocene assemblages available along the European Atlantic frontage and important for understanding the distribution/palaeobiogeography of Pliocene Atlanto-Mediterranean molluscs (see Silva *et al*., 2006, 2010).
The Miocene to Pliocene sedimentary sequence exposed at this locality is part of the Cainozoic Mondego Basin, the fossiliferous Pliocene sediments corresponding to the basal transgressive beds of the Carnide Sandstone Formation (Cachão, 1990; Diniz *et al*., 2016). The calcareous nannofossil assemblage from these beds indicates placement in the biozone CN12a of Okada & Bukry (1980). Based on calcareous nannofossils and gastropod molluscs, these beds have been assigned to the uppermost Zanclean to lower Piacenzian (Cachão, 1990; Silva, 2001; Diniz *et al*., 2016). The molluscan fauna of Vale de Freixo, as well as all the known marine Pliocene Atlantic molluscan assemblages of the Mondego Basin, correlate to the Mediterranean Pliocene Molluscan Unit 1 (MPMU1) as defined by Monegatti & Raffi (2001) for the Mediterranean (Silva *et al*., 2010). For more information on the general geological setting and the stratigraphy of the Vale de Freixo site and additional references see Silva *et al*. (2006, 2010) and Diniz *et al*. (2016).

Material and methods

These superfamilies consist mainly of small to minute species that require high magnification photography and their protoconch to be preserved in order to be able to identify them with any certainty. To this end, almost all the imaging is done by scanning electron microscopy.
Chirli & Micali (2011) offered a revision of the superfamily Pyramidelloidea Gray, 1840 in the Pliocene assemblages of Tuscany, Italy. They gave an exhaustive chresonymy of both fossil and present-day references, and a description for each species. In this work we will concentrate on fossil references, in which the specimens have been illustrated, and we can ascribe them to that species with a certain degree of confidence. We also give a more detailed stratigraphical and geographical distribution of each genus and species, which is essential in elucidating the palaeobiogeography of the region.

Some authors working with pyramidellids have tended to use the genera as relatively wide concepts (*e.g*., Peñas *et al*., 1996; Peñas & Rolán, 1997, 1998, 1999a, 2011; Chirli & Micali, 2011; *inter alia*). Based on molecular data, Schander *et al*. (2003) showed that the usage of *Brachystomia* Monterosato, 1884 and *Megastomia* Monterosato, 1884 as subgenera of *Odostomia* Fleming, 1813 is not supported, and shall be used as valid genera herein, and that *Turbonilla*, as interpreted by most authors, is polyphyletic. The work by Schander *et al.* (2003) was based on the study of few species and we await further molecular phylogenetic works on the family. More recently there have been attempts to expand on this data and recognise smaller monophyletic groups within the Pyramidelloidea (Giannuzzi-Savelli *et al*., 2014; Landau & LaFollette, 2015; Peñas & Rolán, 2017; Landau *et al*., 2020). In this paper we continue to adopt this stricter generic concept in order to identify monophyletic groups and give a detailed stratigraphical and geographical distribution to each species, which is essential in elucidating the palaeobiogeography of the region.

The material described herein was collected from several localities around Estepona (for a map of localities see, Landau *et al*., 2003: 4, text-fig. 1). The new material is housed in the Natural History Museum Vienna (NHMW) and in the personal collection of Henk Mulder (Monster, The Netherlands). Henk Mulder's private collection will eventually be donated to the Naturalis Biodiversity Center (Leiden, The Netherlands).

A large amount of the material in this paper was collected by Henk Mulder of Monster, The Netherlands, between the years 2008-2020, and we have great pleasure in dedicating some of the species herein to Henk and his family in recognition of his dedication, tireless collecting efforts, and generosity in making his material available for study.

In the course of this work we have often encountered discrepancy in protoconch dimensions between populations, especially between the fossil specimens from Estepona and present-day West African specimens. In pyramidellids protoconch size can be variable not only between populations geographically separated, but also depend on temperature and salinity (Robertson, 2012). Fretter *et al.* (1986), when dealing with extant North Atlantic pyramidellid species, often indicated a range of variability in protoconch dimension of about 15%. A well-known case of protoconch size variability is seen in *Eulimella acicula* (Philippi, 1836), based on the study of Mediterranean present-day material. Nofroni & Tringali (1995) separated *E. acicula* from *E. subcylindrata* (Dunker *in* Weinkauff, 1862) mainly for the larger protoconch.

Other specimens corresponding with *E. acicula*, but with an even larger protoconch, have also been observed from Spanish Mediterranean coasts (PM unpublished data). Moreover, protoconch size can change over geological time (*e.g.*, *Pyrgostilus striatulus*/*lanceae* complex; Micali, 1994). Many of these West African species are known from relatively few specimens and the number of these on which the protoconch measurements are taken is unclear. Therefore, as far as protoconch dimensions are concerned, we adopt a relatively broad species concept.

For a detailed discussion on the protoconch and columellar terminology used in this work see Landau *et al*. (2020, p. 280-281).

Abbreviations:

NHMW	Naturhistorisches Museum Wien collection (Vienna, Austria)
CO	Velerín conglomerates
EL	El Lobillo
PQ	Parque Antena
VC	Velerín carretera
dp	diameter protoconch
hp	height protoconch
dn	diameter nucleus

Systematics

Superfamily Murchisonelloidea Casey, 1904
Family Murchisonellinae Casey, 1904
Subfamily Ebalinae Warén, 1995
Genus *Ebala* Gray, 1847

Type species (by monotypy) – *Turbo nitidissimus* Montagu, 1803, present-day, British Isles.

1847b *Ebala* Gray, p. 160.

Note – The species here included have historically been placed in the genus *Anisocycla* Monterosato, 1880 (*auct*.; *e.g.*, Peñas & Rolán, 2001a, p. 56), characterised by tall, very slender shells, with or without sculpture, without columellar fold or umbilicus and a type B planispiral protoconch with the spire entirely visible. However the type species of *Anisocycla* is *Eulimella ventricosa* (Forbes, 1844), and the genus was synonymised with *Eulimella* by Warén (2013). Warén (1995) removed *Ebala* from the Pyramidellidae and placed it in the family Murchisonellidae Casey, 1904. A position reconfirmed in a subsequent publication (Warén, 2013). Because of the similar shell morphology to pyramidellids we include them in this monograph.

***Ebala eulimoides* (Fekih, 1969)**
Plate 1, fig. 1

*1969	*Anisocycla eulimoides* Fekih, p. 57, pl. 11, fig. 15.
2003	*Anisocycla eulimoides* Fekih, 1969 – Moreno *et al*., p. 137, figs 108-109.
2014	*Ebala eulimoides* (Fekih, 1969) – Giannuzzi-Savelli *et al*. (*partim*), p. 94, fig. 330, appendix p. 39, 87 (not fig. 329).
non 2011	*Ebala eulimoides* (Fekih, 1969) – Chirli & Micali, p. 110, pl. 39, figs 10-12 [= *Ebala subscalarina* (Fekih, 1969)].

Material and dimensions – Maximum height 1.3 mm, width 560 μm. **EL**: NHMW 2019/0167/0299 (1), NHMW 2019/0167/0300 (1).

Description (based on Estepona material) – Shell minute, fusiform-pupoid. Protoconch planispiral type B, about two whorls, tilted at about 142° from main shell axis (dp = 215 μm). Teleoconch of three convex whorls, separated by a strongly oblique, moderately impressed suture. Surface smooth, except for inconspicuous prosocline growth lines. Last whorl elongated, 57% total height, base poorly delimited by rounded basal angulation, imperforate. Aperture ovate, 31% total height, outer lip simple (incomplete in the material at hand).

Discussion – This species is problematic. Fekih (1969) described two closely similar species from the lower Pliocene of Tunisia: *Anisocycla subscalarina* and *A. euli-*

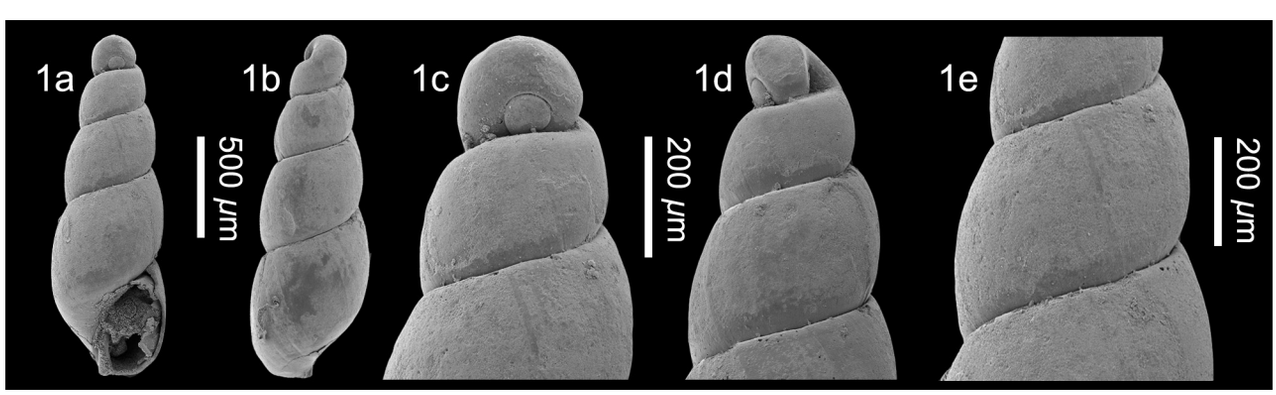

Plate 1. *Ebala eulimoides* (Fekih, 1969); 1. NHMW 2019/0167/0299, height 1.3 mm, width 560 μm, 1c-d, detail of protoconch, 1e detail of penultimate teleoconch whorl (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

moides. The description of *A. eulimoides* is structured as a comparison to the former "*elle diffère* [from *A. subscalarina*] *par ses tours plus convexes et très élargis à la base, par sa suture plus oblique, moins large et moins profonde; son dernier tour est nettement plus dévelopée et vaut, à lui seul, les 2/3 de la longueur de la coquille. Sa base est plus convexe et possède un léger cou en avant. L'ouverture est moins étalée avec un labre moins droit*" (Fekih, 1969, p. 57). Sculpture was not mentioned and the original figures are too poor to ascertain if such fine sculpture is present or not, but *A. subscalarina* was described as being smooth or having very fine sculpture under high magnification. Gougerot & Fekih (1980) recorded it living in Tunisia and Libya.

Both species were recognised in the Italian Pliocene by Chirli & Micali (2011) and transferred to the genus *Ebala* Gray, 1847. Judging from their figures, the main difference between the two species seems to be the much deeper suture in *E. subscalarina*. Chirli & Micali (2011, p. 111) described fine spiral sculpture on the base of *E. subscalarina*, whereas for *E. eulimoides* Chirli & Micali noted "*I giri della teleoconca non presentano alcun tipo d'ornamentazione tranne le esilissime strie d'accrescimento* [the teleoconch whorls lack any sculpture, except for extremely fine growth lines]." (2011, p. 110). However, the figured specimen also clearly shows fine spiral sculpture on the base.

The Estepona material is too scant to give an idea of intraspecific variability, but it does not have any spiral sculpture (Pl. 1, fig. 1e) and the suture is not as deep as that illustrated for *E. subscalarina*. We consider it to represent *E. eulimoides*. The specimen illustrated by Chirli & Micali (2011, pl. 39, figs 10-12) from the Italian Pliocene with spiral sculpture on the base probably represents a further specimen of *E. subscalarina*, and is very similar to one of the other specimens illustrated by those authors (2011, pl. 40, figs 12-14).

One of the two specimens figured by Giannuzzi-Savelli *et al*. (2014, fig. 329) has relatively strong spiral sculpture throughout the teleoconch and is not *E. eulimoides*. The second specimen from Marbella (Spain) (Giannuzzi-Savelli *et al*., 2014, fig. 330) is a SEM image, the same used by Peñas *et al*. (1996, fig. 86) to illustrate *E. trigonostoma* (de Folin, 1871). Later, Peñas & Rolán (2001a, p. 58) hypothesised that *E. eulimoides* might have been an Indo-Pacific species, as the type locality was the Suez Canal, and reascribed their previously published photo to *E. gradata* (Monterosato, 1878). However, the specimen does not represent *E. gradata*, and differs in having higher, more regularly convex whorls and the last whorl is higher and narrower (compare fig. 86 in Peñas *et al*., 1996 vs fig. 7 in Peñas & Rolán, 2001a). The lectotype of *E. trigonostoma*, deposited at MNHN was photographed by Shigeo Hori (photo is in Giannuzzi-Savelli *et al*., 2014, fig. 331, as well as on the MNHN website). This specimen is clearly different from *E. eulimoides*. This led Giannuzzi-Savelli *et al*. (2014, p. 94) to ascribe the specimen from Marbella to *E. eulimoides*, with which we concur.

Two further non-striated congeners occur in the European extant faunas; *E. pointeli* (de Folin, 1868) is taller spired, with more numerous teleoconch whorls that are more convex, and has a type A1 protoconch. *Ebala trigonostoma* (de Folin, 1871) has more 'barrel-shaped' whorls and a scalate profile.

Distribution – Middle Miocene: western Proto-Mediterranean, NE Spain (Moreno *et al*., 2003). Lower Pliocene: central Mediterranean, Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Villalvernia, Italy (PM collection, unpublished data). Present-day: western Mediterranean, southern Spain (Giannuzzi-Savelli *et al*., 2014), Lybia and Tunisia (Gougerot & Fekih, 1985).

***Ebala nitidissima* (Montagu, 1803)**
Plate 2, fig. 1

*1803	*Turbo nitidissimus* Montagu, p. 299, pl. 12, fig. 1.
1848	*Chemnitzia nitidissima* (?) Mont. – Wood, p. 80, pl. 10, fig. 4.
1964	*Eulimella* (*Elaba*) *nitidissima* (Montagu, 1803) – van Regteren Altena *et al*., p. 46, pl. 21, fig. 199.
1969	*Anisocycla Nitidissima* [*sic*] Montagu – Fekih, p. 56, pl. 11, fig. 11.
1972b	*Ebala nitidissima* (Montagu, 1803) – Nordsieck, p. 120, pl. PVII, fig. 12.
1984	*Anisocycla nitidissima* (Montagu, 1803) – Van Aartsen *et al*., p. 50, fig. 243.
1986	*Ebala nitidissima* (Montagu, 1803) – Fretter *et al*., p. 629, figs 439, 440.
1988	*Ebala nitidissima* (Montagu, 1803) – Graham, p. 618, fig. 270.
1993	*Ebala nitidissima* (Montagu, 1803) – Iljina, p. 117, pl. 16, figs 10, 11.
1994	*Anisocycla nitidissima* (Montagu, 1803) – Van Aartsen, p. 94, fig. 12.
1995	*Ebala nitidissima* (Montagu) – Warén, p. 204, fig. 1A-C.
1996	*Ebala nitidissima* (Montagu, 1803) – Peñas *et al*., p. 74, figs 87, 88, 92.
1997	*Anisocycla nitidissima* (Montagu, 1803) – Marquet, p. 106, pl. 9, fig. 13.
1998	*Anisocycla nitidissima* (Montagu, 1803) – Marquet, p. 193, fig. 165.
2001a	*Anisocycla nitidissima* (Montagu, 1803) – Peñas & Rolán, p. 60, figs 8-16.
2001	*Ebala nitidissima* (Montagu, 1803) – Cachia *et al*., p. 117, pl. 19, fig. 7.
2002	*Ebala nitidissima* (Montagu, 1803) – Chirli & Bogi, p. 21, fig. 15.
2005	*Anisocycla nitidissima* (Montagu, 1803) – Rolán, p. 181, fig. 852.
2009	*Ebala nitidissima* (Montagu, 1803) – de Frias Martins *et al*., p. 66, figs 275-276.
2011	*Ebala nitidissima* (Montagu, 1803) – Chirli & Linse, p. 210, pl. 83, fig. 3.
2011	*Ebala nitidissima* (Montagu, 1803) – Hernández *et al*., p. 268, figs 91B-D.
2013	*Anisocycla nitidissima* (Montagu, 1803) – Landau

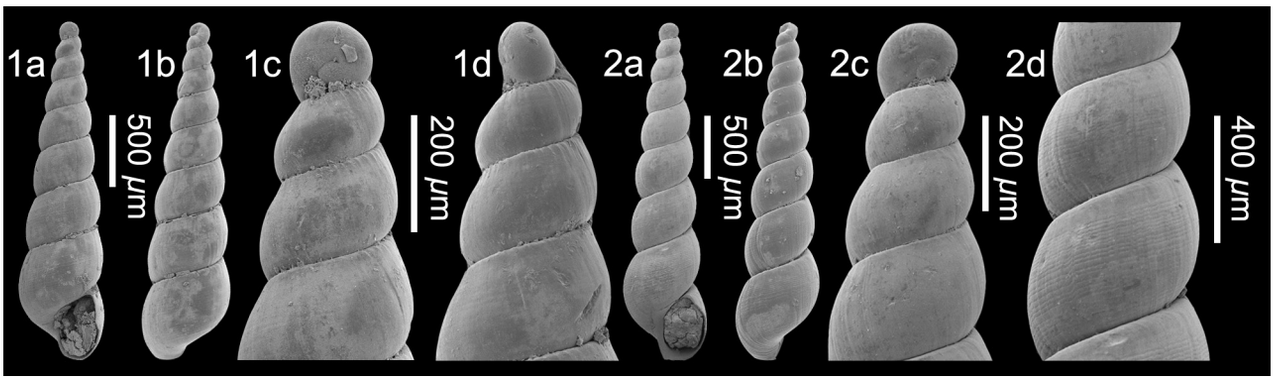

Plate 2. *Ebala nitidissima* (Montagu, 1803); 1. NHMW 2019/0167/0297, height 2.4 mm, width 605 µm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0298, height 2.7 mm, width 625 µm, 2c, detail of protoconch, 2d, detail of late teleoconch whorl sculpture (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

et al., p. 321, pl. 76, fig. 9.
2013 *Anisocycla nitidissima* (Montagu, 1803) – Öztürk & Bitlis Bakir, p. 425, fig. 3.
2014 *Ebala nitidissima* (Montagu, 1803) – Giannuzzi-Savelli *et al*., p. 94, fig. 326, appendix p. 39, 86.
2018 *Ebala nitidissima* (Montagu, 1803) – Trigo *et al*., p. 365, fig. 1.

Material and dimensions – Maximum height 2.4 mm, width 605 µm. **VA**: NHMW 2019/0167/0296 (1). **EL**: NHMW 2019/0167/0297-0279 (2), NHMW 2019/0167/0549 (6).

Discussion – *Ebala nitidissima* (Montagu, 1803) is characterised by its small size, very tall slender shell composed of 6-8 convex whorls, separated by an impressed, markedly oblique suture. The teleoconch whorls bear very fine spiral sculpture (Pl. 2, fig. 2d). The sculpture was also illustrated in extant specimens by Fretter *et al*. (1986, fig. 440). The protoconch is composed of about two whorls, type B planispiral, tilted at about 135° to the main shell axis (Estepona specimen; dp = 150 µm). Fretter *et al*. (1986, p. 629) also described a protoconch of two whorls (see also Peñas & Rolán, 2001a, fig. 13). The diameter of the protoconch varies between 150-160 µm. The maximum diameter of 430 µm quoted by Fretter *et al*. (1986, p. 630) is likely to be incorrect.
Ebala pointeli (de Folin, 1868) is similar in shape, but has a type A protoconch and lacks spiral sculpture. *Ebala striatula* (Jeffreys, 1856) is also spirally striate and has a type B protoconch, but the whorl profile is 'barrel-shaped' and not evenly convex as in *E.nitidissima*, the last whorl and aperture are more elongate.

Distribution – Middle Miocene: eastern Paratethys (Langhian-Serravallian): (Iljina, 1993); Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Lower Pliocene: North Sea Basin, England (Wood, 1848); central Mediterranean, Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, Belgium (Marquet, 1997, 1998), Netherlands (Van Regteren Altena *et al*., 1964); western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Chirli & Bogi, 2002); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic European coast from British Isles (Nordsieck, 1972b; Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), Azores (Nordsieck, 1972b; de Frias Martins *et al*., 2009), West Africa south to Angola, Canaries (Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), Cape Verde Islands (Nordsieck, 1972b; Peñas & Rolán, 2001a; Rolán, 2005), into western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

Ebala pointeli **(de Folin, 1868)**
Plate 3, figs 1-2

*1868 *Turbonilla Pointeli* de Folin, p. 100, pl. 11, fig. 4.
1972b *Ebala pointeli* (de Folin, 1867 [*sic*]) – Nordsieck, p. 120, pl. PVII, figs 7, 8.
1980 *Anisocycla pointeli* (de Folin) – Gougerot & Fekih, p. 27, pl. 1, figs 8-9, 13-17.
1994 *Anisocycla pointeli* (De Folin, 1868) – Van Aartsen, p. 94, 108, fig. 13.
1996 *Ebala pointeli* (de Folin, 1868) – Peñas *et al*., p. 75, figs 82, 83, 85.
2001a *Anisocycla pointeli* (De Folin, 1868) – Peñas & Rolán, p. 58, figs 3-6.
2001 *Ebala pointeli* (de Folin, 1867 [*sic*]) – Cachia *et al*., p. 118, pl. 19, fig. 8.
2005 *Anisocycla pointeli* (De Folin, 1868) – Rolán, p. 182, fig. 853.
2011 *Ebala pointeli* (De Folin, 1868) – Chirli & Micali, p. 110, pl. 39, figs 13-15, pl. 40, figs 1-8.
2011 *Ebala pointeli* (De Folin, 1868) – Chirli & Linse, p. 210, pl. 83, fig. 4.
2011 *Ebala pointeli* (De Folin, 1868) – Hernández *et al*., p. 268, figs 91E-F.
2013 *Anisocycla pointeli* (De Folin, 1868) – Öztürk & Bitlis Bakir, p. 426, fig. 4.

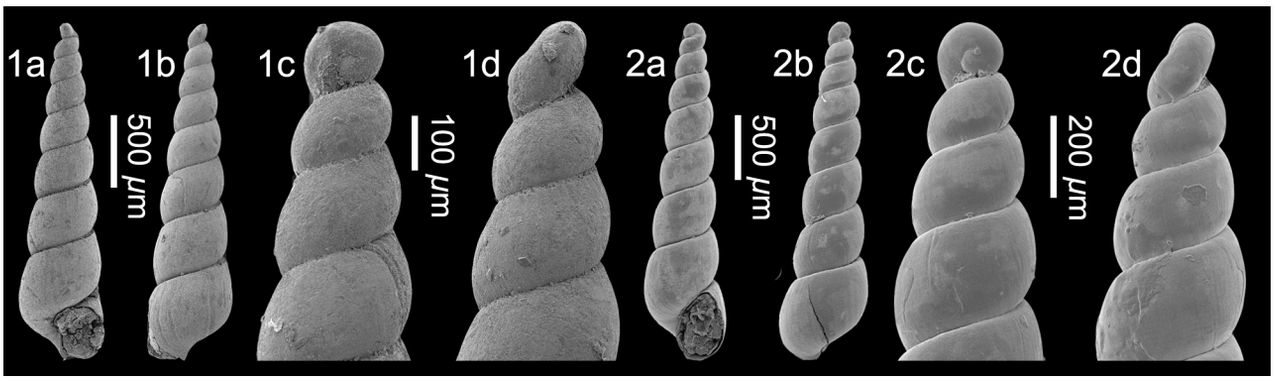

Plate 3. *Ebala pointeli* (de Folin, 1868); 1. NHMW 2019/0167/0801, height 2.4 mm, width 575 µm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0802, height 2.5 mm, width 585 µm, 2c-d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

2014 *Ebala pointeli* (de Folin, 1868) – Giannuzzi-Savelli *et al*., p. 94, fig. 327, appendix p. 39, 87.

Material and dimensions – Maximum height 2.5 mm, width 585 µm. **EL**: NHMW 2019/0167/0801-0802 (2), NHMW 2019/0167/0803 (12).

Discussion – *Ebala pointeli* (de Folin, 1868) is characterised by its small size, very tall slender shell composed of 6-8 convex whorls, separated by an impressed, markedly oblique suture. The teleoconch is smooth, except from prosocline growth lines, and the protoconch is very elevated, composed of 1.5 whorls, type B planorbid (Estepona specimens; dp = 150-155 µm, dn = 55-60 µm, tilted at 115-120° to main shell axis). The protoconch size and angle are comparable to those of the present-day specimen illustrated by Peñas & Rolán (dp = 160 µm; 2001a, figs 3-6) from Mauritania.
It differs from *Ebala nitidissima* (Montagu, 1803) in having completely smooth teleoconch whorls.

Distribution – Lower Pliocene: central Mediterranean (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: central Mediterranean, Sicily (Chirli & Micali, 2011). Present-day: Atlantic coast of West Africa Sahara to Ghana, Canaries (Peñas & Rolán, 2001a; Hernández *et al*., 2011), Madeira and Selvagens Islands (Van Aartsen *et al*., 2000; Segers *et al*., 2009), Cape Verde Islands (Rolán, 2005), into western Mediterranean (Van Aartsen, 1994; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

Genus *Pseudochileutomia* Friedberg, 1938

Type species (by monotypy) – *Pseudochileutomia minima* Friedberg, 1938, Miocene, Poland.

1938 *Pseudochileutomia* Friedberg, p. 157, pl. 3, fig. 1.

Note – Giannuzzi-Savelli *et al*. (2014, p. 38, 86) discussed the generic placement of *Eulimella carinata* de Folin, 1870 and noted that the soft part anatomy was unknown. They argued against the most recent placement in the genus *Bacteridium* Thiele, 1929, and noted the similarity to the Polish Miocene fossil species *Pseudochileutomia minima* Friedberg, 1938. With the scant material available and lack of soft parts, we cannot add to this discussion and follow the position taken by Giannuzzi-Savelli *et al*. (2014).

***Pseudochileutomia carinata* (de Folin, 1870)**
Plate 4, figs 1-2

*1870 *Eulimella carinata* de Folin, p. 209, pl. 28, fig. 8.
1994 *Bacteridium carinatum* (de Folin, 1870) – Schander, p. 14, figs 1c, 9e, f.
1996 *Bacteridium carinatum* (de Folin, 1870) – Peñas *et al*., p. 73, fig. 81.
1997 *Bacteridium carinatum* (de Folin, 1869 [*sic*]) – Bogi & Bella, p. 43, fig. 7.
2000 *Anisocycla* cf. *carinata* (de Folin, 1870) – Aartsen *et al*., p. 18, fig. 20.
2001a *Bacteridium carinatum* (de Folin, 1870) – Peñas & Rolán, p. 56, figs 1, 2.
2014 *Pseudochileutomia carinata* (de Folin, 1870) – Giannuzzi-Savelli *et al*., p. 94, figs 322-324, appendix p. 38, 86.

Material and dimensions – Maximum height 1.2 mm, width 445 µm. **EL**: NHMW 2019/0167/0600-0601 (2).

Discussion – The material from Estepona is scarce and imperfectly preserved, but undoubtedly represents *Pseudochileutomia carinata* (de Folin, 1870). The species is characterised by its minute size, planispiral type B protoconch, telescopic subcylindrical teleoconch whorls, strongly shouldered just below the suture, which is deep and strongly oblique, flexuous opisthocline growth lines, very fine spiral sculpture often restricted to the periphery, and subquadrangular aperture without a columellar fold. As far as we are aware, this is the first fossil record

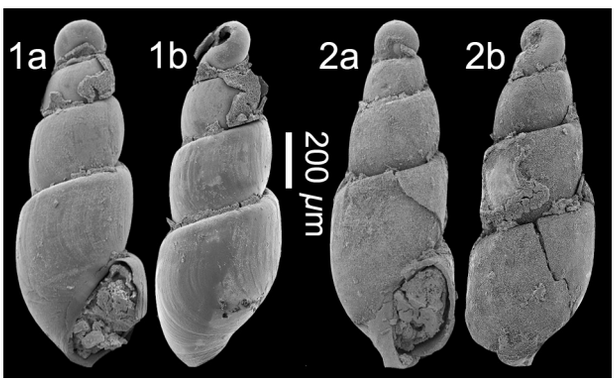

Plate 4. *Pseudochileutomia carinata* (de Folin, 1870); 1. NHMW 2019/0167/0600, height 1.2 mm, width 445 μm; 2. NHMW 2019/0167/0601, height 1.2 mm, width 440 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

for the species. *Pseudochileutomia minima* Friedberg, 1938 from the middle Miocene Paratethys of Poland was based on a single specimen. The original description is accompanied by a drawing of a specimen that is clearly closely similar to *P. carinata*, possibly with a slightly weaker subsutural shoulder. This description and illustration are insufficient to conclude if they are distinct or represent a single species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: Atlantic West Africa southwards to Angola (Schander, 1994; Aartsen *et al*., 2000; Giannuzzi-Savelli *et al*., 2014; Peñas & Rolán, 2001a), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Bogi & Bella, 1997).

Family Cimidae Warén, 1995
Genus *Graphis* Jeffreys, 1867

Type species (by monotypy) – *Turbo unicus* Montagu, 1803, present-day, British Isles.

1867 *Graphis* Jeffreys, p. 102.
1869 *Cioniscus* Jeffreys, p. 210. Unnecessary substitute name.

***Graphis albida* (Kanmacher, 1798)**
Plate 5, fig. 1

*1798 *Turbo albidus* Kanmacher, p. 637, pl. 14, fig. 17.
1803 *Turbo unicus* Montagu, p. 299, pl. 12, fig. 1.
1852 *Turritella Clelandiana* Leach *in* Gray, p. 159.
1875 *Truncatella minuscula* de Folin, p. 145, pl. 3, fig. 3.
1879 *Dunkeria Marioni* de Folin, p. 227, pl. 1, fig. 7.
1968 *Aclis* (*Graphis*) *unica* (Montagu) – Nordsieck, p. 86, pl. 14, fig. 49.50
1969 *Aclis farolita* Nordsieck, p. 255, pl. 1, unnumbered fig.
1982 *Cioniscus albidus* (Kanmacher, 1798) – Fretter & Graham, p. 404, figs 289-290.
1997 *Graphis albida* (Kanmacher, 1798) – Giribret & Peñas, p. 50, figs 32-34.
2002 *Graphis albida* (Kanmacher, 1798) – Van Aartsen, p. 9, figs 3-4.
2002 *Graphis albida* (Kanmacher, 1798) – Chirli & Bogi, p. 21, fig. 14)
2003 *Graphis albida* (Kanmacher, 1798) – Moreno *et al*., p. 135.
2005 *Graphis albida* (Kanmacher, 1798) – Rolán, p. 112, figs 299-300.
2011 *Graphis albida* (Kanmacher, 1798) – Hernández *et al*., p. 269, figs 91K-N.
2013 *Graphis albida* (Kanmacher, 1798) – Chirli, p. 5, figs 7-12.
2014 *Graphis albida* (Kanmacher, 1798) – Giannuzzi-Savelli *et al*., p. 100, fig. 348, appendix p. 42, 89.
2020 *Graphis albida* (Kanmacher, 1798) – Raven, p. 43, fig. 63.

Material and dimensions – Height 2.1 mm, width 600 μm. **EL**: NHMW 2019/0167/0574 (1), NHMW 2019/0167/0800 (2).

Discussion – *Graphis albida* (Kanmacher, 1798) is characterised by its tall, minute, slender, conical shell, bulbous protoconch of about two whorls, up to ten convex teleoconch whorls bearing sinuous axial ribs, about 30 on the penultimate whorl, and fine spiral threads visible only in the axial interspaces, the spirals weaker or absent in the adapical half of the whorl.
A few incomplete specimens from El Lobillo are ascribed to *Graphis albida*. The protoconch is slightly more depressed than seen in present-day Atlantic specimens (Estepona specimen; dp = 215 μm, hp = 215 μm), but is similar to measurements taken from extant Mediterranean specimens (dp = 210 μm, hp = 200-210 μm; PM unpublished data). The measurements given by Fretter & Graham (dp = 65 μm, hp = 130 μm; 1982, p. 404) may be an error. The protoconch was also clearly illustrated by Giribet & Peñas (1997, fig. 34). Although a scalebar

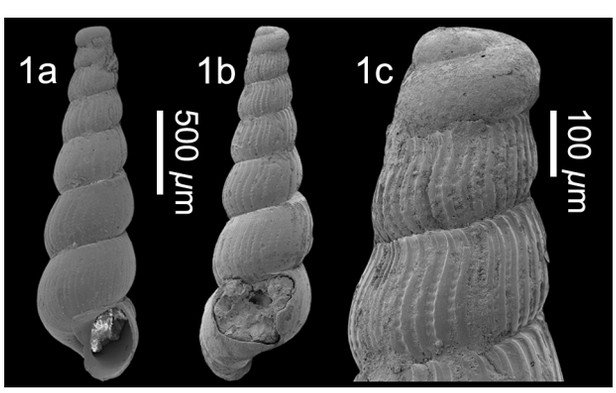

Plate 5. *Graphis albida* (Kanmacher, 1798); 1. NHMW 2019/0167/0574, height 2.1 mm, width 600 μm, 1c, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

was added, the authors omitted to say what the scale was. Assuming the bar to represent 100 μm, then for the eastern Mediterranean specimen's protoconch measurements (dp = 200 μm, hp = 230 μm) also conforms with those of the present-day central Mediterranean and Estepona fossil specimen. A further slight difference is that in the Estepona specimen the early teleoconch whorls are less convex and have more numerous ribs than usual. However, the number of ribs is variable, and the profile of the later teleoconch whorls is similar to that seen in extant specimens.

Graphis barashi Van Aartsen, 2002 from the eastern Mediterranean is closely similar, and differs most importantly in having a more pointed protoconch consisting of two whorls.

Although not illustrated, we have included the reference of Moreno *et al*. (2003), as this is the only reliable reference to the species occurring in the Miocene.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Bogi, 2002; Chirli, 2013). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0336); western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: eastern Atlantic, south Norway, British Isles (Fretter & Graham, 1982), North Sea (Raven, 2020) to Canaries (Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), Cape Verde Islands, West Africa (Rolán, 2005), central Mediterranean, Italy (Giannuzzi-Savelli *et al*., 2014).

***Graphis pruinosa* Gofas & Rueda, 2014**
Plate 6, figs 1, 2

2014 *Graphis pruinosa* Gofas & Rueda, *in* Gofas *et al*., p. 546, fig. 7A-G.

Material and dimensions – Maximum height 1.8 mm, width 495 μm. **EL**: NHMW 2019/0167/0571-0572 (2), NHMW 2019/0167/0738 (1).

Discussion – This species is characterised by its minute size, elongate-cylidrical profile, protoconch of two whorls with weakly developed spiral cords, medially carinate, teleoconch whorls strongly convex, separated by deeply impressed suture, and base delimited by very weak cord. The teleoconch surface is covered in very narrow, close-set, finely punctate spiral grooves and flexuous growth lines. The fossil specimens from Estepona are closely similar to the types from the Alboran Sea dredged at about 360 m depth. As discussed by Gofas *et al*. (2014, p. 547), this species is similar to *Graphis gracilis* (Monterosato, 1874), which has a protoconch of almost identical shape and sculpture, but differs in lacking the strong axial ribs present in *G. gracilis*, and in the presence of fine spiral grooves, absent in the latter. We follow Gofas *et al*. (2014) in placing this species in the genus *Graphis* Jeffreys, 1867, although the marked sculptural differences between *G. pruinosa* and the type species of *Graphis*, *G. gracilis* suggest the two species may not be congeneric.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: western Mediterranean (Gofas *et al*., 2014).

Superorder Pylopulmonata Teasdale, 2017
Superfamily Pyramidelloidea Gray, 1840
Family Pyramidellidae Gray, 1840
Tribe Pyramidellini Gray, 1840
Genus *Longchaeus* Mörch, 1875

Type species – *Pyramidella punctata* Férussac, 1821, by subsequent designation (Dall & Bartsch, 1904, p. 4, as *Pyramidella punctata* Chemnitz; invalid, ICZN, 1944, 1954), Holocene, Polynesia and Indian Ocean.

1875 *Longchaeus* Mörch, p. 158.
1889 *Pharcidella* Dall, p. 333. Type species (by original designation): *Pyramidella* (*Pharcidella*) *folinii* Dall, 1889, Recent, Caribbean.
1903 *Callolongchaeus* Dall, p. 1584. Type species (by original designation): *Pyramidella* (*Longchaeus*) *jamaicensis* Dall, *in* Guppy & Dall, 1896, Pliocene, Jamaica.

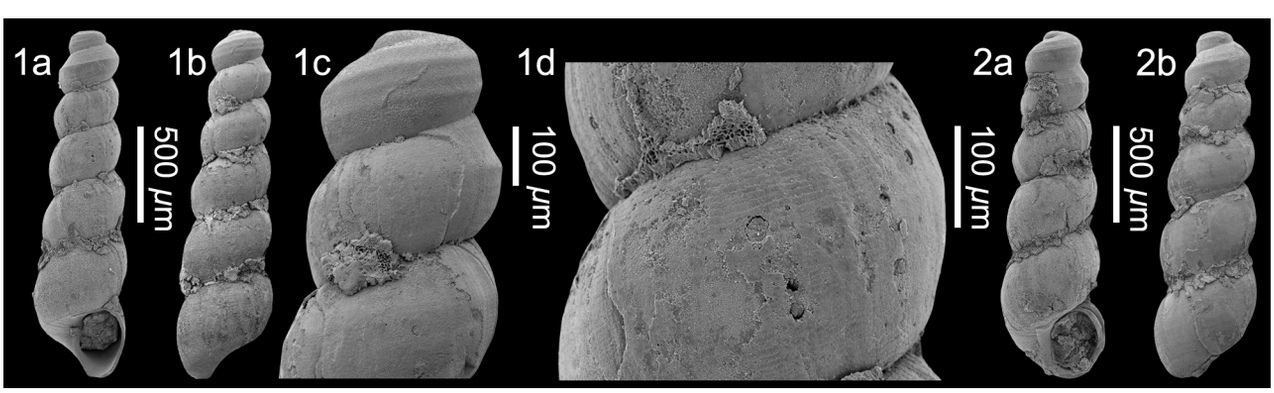

Plate 6. *Graphis pruinosa* Gofas & Rueda, 2014; 1. NHMW 2019/0167/0571, height 1.8 mm, width 480 μm, 1c, detail of protoconch, 1d, detail of teleoconch whorl sculpture; 2. NHMW 2019/0167/0572, height 1.8 mm, width 495 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

1904 *Voluspa* Dall & Bartsch, p. 4. Type species (by original designation): *Pyramidella auricoma* Dall, 1889, Recent, Gulf of California.
1959 *Wingenella* Laseron, p. 190. Type species (by original designation): *Wingenella eburnea* Laseron, 1959, Queensland, Australia, Recent.

For discussion see Landau & LaFollette (2015, p. 15).

***Longchaeus inopinatus* (Schander, 1994)**
Plate 7, fig. 1

1885 *Obeliscus suturalis* von Maltzan, p. 26 [*non Lonchaeus suturalis* (H.C. Lea, 1843)].
*1994 *Pharcidella* (*?*) *inopinata* Schander, p. 48, figs 7c, 13 g-h.
1998 *Pyramidella* (*Longchaeus*) *schanderi* Van Aartsen *et al*., p. 6, fig. 1.
2014 *Pyramidella* (*Longchaeus*) *inopinata* Schander, 1994 [*sic*] – Peñas *et al*., p. 108, fig. 1B.

Material and dimensions – Height 9.1 mm, width 3.2 mm. **EL**: NHMW 2019/0167/0687 (1).

Discussion – Schander (1994) described *Pharcidella inopinata* from the present-day Cape Verde Islands and considered it distinct from *Obeliscus suturalis* von Maltzan 1885 (name preoccupied by *Pyramidella suturalis* H.C. Lea, 1843, renamed *Pyramidella* (*Longchaeus*) *schanderi* by Van Aartsen *et al*. (1998). After re-examination of a large number of specimens, Peñas *et al*. (2014, p. 110) concluded that they were synonymous and used the first available name: *Pyramidella* (*Longchaeus*) *inopinata* (Schander, 1994).
This species is characterised by its extremely solid shell, regularly conical spire, deeply sunken type A1 protoconch, tilted at angle of 115° to the main shell axis, teleoconch of up to nine weakly convex whorls, smooth except for orthocline growth lines, separated by a moderately deeply impressed suture, last whorl roundly angled at the periphery, imperforate, and extremely strong apertural armature consisting of at least three stout outer lip denticles (possibly one further tooth; lip incomplete), adapical stronger, and three elevated columellar folds, adapical stronger, extremely elevated and sharp. In the extant faunas the convexity of the whorls, the depth of the suture, strength of the growth lines and apertural armature are variable. The protoconch in the Estepona specimen has very similar size and tilt to the extant specimens (dp = 275 μm vs 290 μm for recent shells, both have tilt of 115°; Schander, 1994, p. 48). The groove at the periphery of the last whorl seen in some of the extant specimens is not present in the Estepona specimen and the suture is slightly shallower than usual, but with only one specimen available we cannot comment on its variability in the Pliocene.
Longchaeus inopinatus is immediately separated from all its Estepona congeners by the extreme thickness of the shell, stronger apertural armature, and type A1 protoconch as opposed to type B. This is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Senegal and Cape Verde Islands (Van Aartsen *et al*., 1998), Ivory Coast to Angola (Peñas *et al*., 2014).

***Longchaeus obtusatus* (Semper, 1861)**
Plate 8, figs 1-4

*1861a *Obeliscus obtusatus* Semper, p. 233.
1861b *Obeliscus obtusatus* Semper, p. 399.
1892a *Pyramidella obtusior* (Semper) – Sacco, p. 29, pl. 1, fig. 59.
1892a *Pyramidella obtusior* var. *parvillima* Sacco, p. 29, pl. 1, fig. 60.
1969 *Pyramidella obtusior* Semper – Fekih, p. 10, pl. 1, fig. 4.
1976 *Pyramidella* (*P.*) *obtusior* (Semper) – Pavia, p. 114, pl. 12, fig. 6.
1992 *Pyramidella obtusior* (Semper, 1861) – Cavallo & Repetto, p. 152, fig. 423.
2011 *Pyramidella obtusata* (Semper, 1861) – Chirli & Micali, p. 3, pl. 1, figs 1-5.

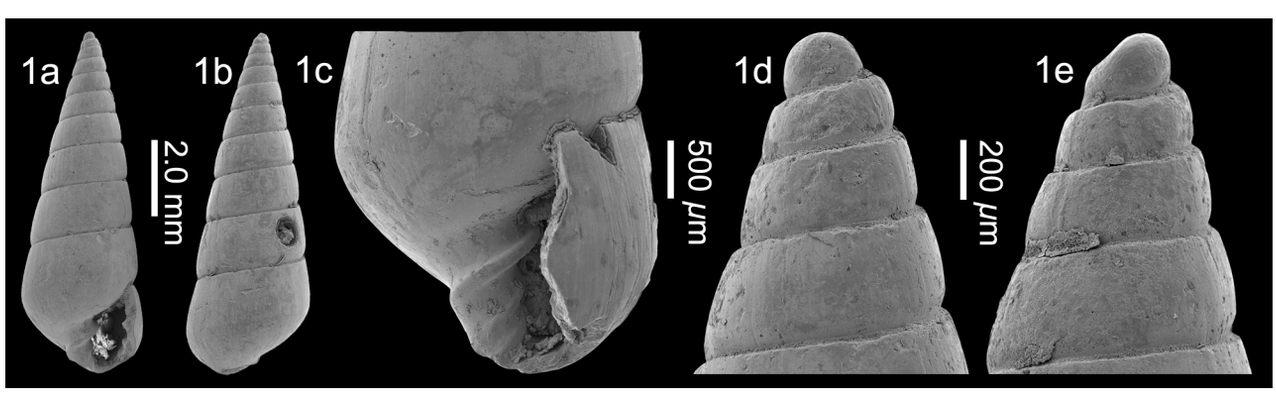

Plate 7. *Longchaeus inopinatus* (Schander, 1994); 1. NHMW 2019/0167/0687, height 9.1 mm, width 3.2 mm, 1c, detail of columellar folds, 1d, e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

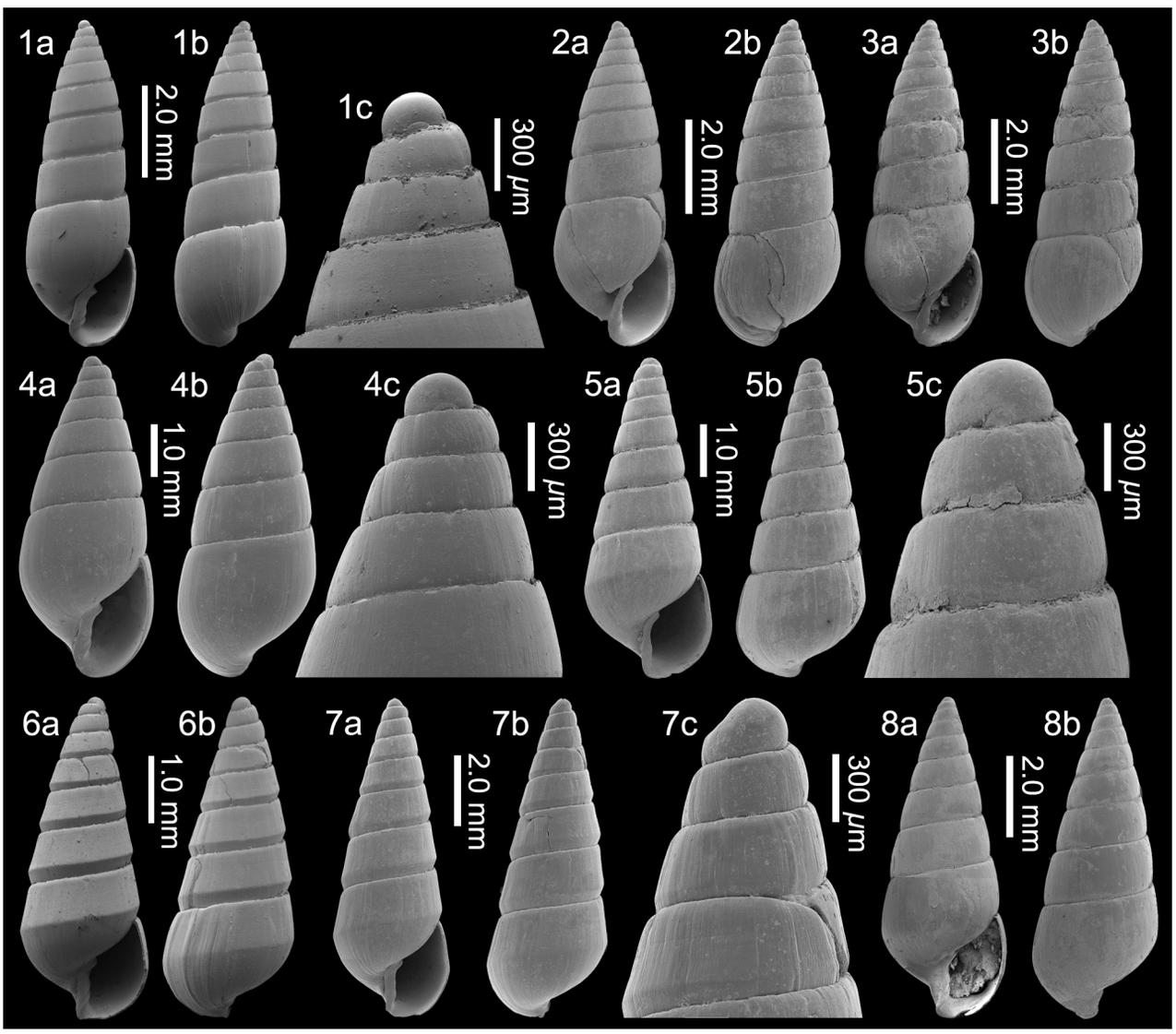

Plate 8. *Longchaeus obtusatus* (Semper, 1861); 1. NHMW 2019/0167/0067, height 7.1 mm, width 2.4 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0460, height 6.4 mm, width 2.4 mm; 3. NHMW 2019/0167/0461, height 7.0 mm, width 2.5 mm; 4. NHMW 2019/0167/0239, height 9.2 mm, width 3.9 mm, 4c, detail of protoconch.
Longchaeus plicosus (Bronn, 1838); 5. NHMW 2019/0167/0462, height 5.8 mm, width 2.2 mm, 5c, detail of protoconch; 6. NHMW 2019/0167/0463, height 5.7 mm, width 2.2 mm; 7. NHMW 2019/0167/0072, height 4.8 mm, width 1.9 mm, 7c, detail of protoconch; 8. var. *sublaeviuscula* Sacco, 1892, NHMW 2019/0167/0241, height 8.1 mm, width 3.2 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 9.7 mm, width 3.1 mm. **CO**: NHMW 2019/0167/0159 (23). **VC**: NHMW 2019/0167/0109 (1), NHMW 2019/0167/0110 (8), NHMW 2019/0167/0239-0240 (2), NHMW 2019/0167/0460-0461 (2). **VS**: NHMW 2019/0167/0811 (1). **EL**: NHMW 2019/0167/0243 (26).

Discussion – *Longchaeus obtusatus* (Semper, 1861) is characterised by its rather broad, squat shell, type B protoconch, deeply submerged into the apex of the teleoconch, so that little more than half of the protoconch is exposed (Estepona specimen; dp = 280 μm), cyrtoconoid spire composed of up to 7-8 weakly convex to almost straight-sided whorls, separated by a linear, impressed to deeply impressed narrowly canaliculated suture, evenly rounded, somewhat globose last whorl, columella bearing three folds; adapical much more strongly developed. The surface is smooth and polished, except for orthocline growth lines, most evident towards the outer lip. Strong denticles are present within the outer lip in some, but not all specimens. *Longchaeus plicosus* (Bronn, 1838) differs in being larger, slenderer, with a taller straight-sided spire composed of more numerous whorls, and in having a relatively smaller and less inflated last whorl.
The trivial names *obtusior* and *obtusatus* have been used for this species. Confusion arose as Semper (1861a, p. 234; 1861b, p. 400) wrote that he had earlier sent this species under the name *obtusior*, but that comparative names

were best avoided, and so he changed it to *obtusatus*. Sacco (1892a, p. 29) wrote "*Il Semper credette poter cangiare il nome di questa specie in* obtusatus*, ciò che non credo da accettarsi*" [Semper thought he could change the name to *obtusatus*, but I do not think this is acceptable]. However, the name *obtusior* seems to be an early manuscript name, and in the headings of the descriptions given by Semper (1861a, p. 233; 1861b, p. 399) the new species is introduced as *Obeliscus obtusatus*, which we consider the correct name for this species.

Distribution – Upper Miocene: central Proto-Mediterranean, Italy (Sacco, 1892a). Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Crovato & Micali, 1992b; Guioli *et al*., 2009; Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992).

***Longchaeus plicosus* (Bronn, 1838)**
Plate 8, figs 5-8

*1838 *Pyramidella plicosa* Bronn, p. 1026, pl. 40, fig. 24.
1842 *Pyramidella laeviuscula* Wood, p. 537.
1854 *Pyramidella Terebellata* Gratt. [*sic*] – Millet, p. 155 (*non* Lamarck, 1804).
1848 *Pyramidella laeviuscula* S. Wood – Wood, p. 77, pl. 9, fig. 2.
1878 *Pyramidella plicosa* Bronn – Nyst, pl. 6, fig. 1.
1882 *Pyramidella plicosa* Bronn – Nyst, p. 71.
1882 *Pyramidella plicosa* Bronn – von Koenen, p. 239, pl. 6, fig. 15.
1892a *Pyramidella plicosa* Bronn – Sacco, p. 609, pl. 1, fig. 53.
1892a *Pyramidella plicosa* var. *suturatissima* Sacc., Sacco, p. 609.
1892a *Pyramidella plicosa* var. *angulatina* Sacc., Sacco, p. 610, pl. 1, fig. 54.
1892a *Pyramidella plicosa* var. *sublaeviuscula* Sacc., Sacco, p. 610, pl. 1, fig. 55.
1892a *Pyramidella plicosa* var. *ovuloides* Sacc., Sacco, p. 610, pl. 1, fig. 56.
1898 *Pyramidella plicosa* var. *minor* Almera & Bofill, p. 52, pl. 3, fig. 8.
1907 *Pyramidella plicosa* Bronn – Ravn, p. 300, pl. 3, fig. 22.
1907 *Pyramidella plicosa* Bronn – Almera, p. 184, pl. 3, fig. 8.
1914 *Pyramidella plicosa* Bronn – Cerulli-Irelli, p. 251 [425], pl. 22 [54], figs 6-12.
1917 *Pyramidella plicosa* Bronn – Cossmann & Peyrot, p. 299, no. 170, pl. 9, figs 8, 9.
1920 *Pyramidella laeviuscula* S.V. Wood – Harmer, p. 558, pl. 49, fig. 8.
1928 *Pyramidella plicosa* Bronn – Friedberg, p. 442, pl. 27, fig. 7.
1944 *Pyramidella* (*Pyramidella*) *plicosa* Bronn – van Voorthuysen, p. 39, pl. 13, figs 18, 19.
1949a *Pyramidella plicosa* Bronn, 1838 – Glibert, p. 197, pl. 12, fig. 11.
1952 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Glibert, p. 62, pl. 4, fig. 17.
1954 *Pyramidella plicosa* Bronn – Strausz, p. 21, pl. 2, fig. 36.
1956 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Rasmussen, p. 102, pl. 10, fig. 6.
1958 *Pyramidella* (*Pyramidella*) *plicosa* Bronn – Sorgenfrei, p. 332, pl. 72, fig. 247.
1958 *Pyramidella laeviuscula* Wood, 1842 – Glibert, p. 21, pl. 2, fig. 18.
1960 *Pyramidella* (*Pyramidella*) *plicosa* (Bronn, 1838) – Kojumdgieva & Strachimirov, p. 96, pl. 30, fig. 5.
1962 *Pyramidella plicosa* Bronn – Strausz, p. 29, pl. 4, figs 28-30, pl. 78, fig. 6.
1964 *Pyramidella plicosa* (Bronn, 1838) – Anderson, p. 329, pl. 50, fig. 293.
1966 *Pyramidella plicosa* Bronn, 1838 – Strausz, p. 190, pl. 4, figs 28-30, pl. 78, fig. 6.
1969 *Pyramidella plicosa* Bronn – Fekih, p. 9, pl. 1, fig. 1.
1969 *Pyramidella suturatissima* Sacco – Fekih, p. 9, pl. 1, fig. 2.
1969 *Pyramidella angulatina* Sacco – Fekih, p. 9, pl. 1, fig. 3.
1972a *Tiberia* (*Cosmannica* [*sic*]) *mioemarginata* Nordsieck, p. 130, pl. 33, fig. 239.
1972a *Pyramidella* (*Voluspa*) *plicosa* Bronn, 1838 – Nordsieck, p. 131, pl. 33, fig. 242.
1973 *Pyramidella* (*Pyramidella*) *plicosa* Bronn – Caprotti & Vescovi, p. 187, pl. 2, fig. 17.
1974 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Malatesta, p. 438, pl. 32, fig. 19.
1976 *Pyramidella plicosa* Bronn – Caprotti, p. 13, pl. 17, fig. 17.
1982 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Martinell, p. 226, pl. 1, figs 10, 11.
1982 *Pyramidella plicosa* Bronn – Martinell & Domènech, p. 18, pl. 2, fig. 9.
1984 *Pyramidella* (*Voluspa*) *plicosa* (Bronn, 1838) – A.W. Janssen, p. 353, pl. 14, figs 17-18.
1989 *Pyramidella plicosa* Bronn, 1838 – Moths, p. 154, pl. 21, fig. 111.
1992 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Cavallo & Repetto, p. 152, fig. 424.
1993 *Pyramidella plicosa* Bronn, 1838 – Iljina, p. 107, pl. 14, fig. 9.
1997 *Pyramidella laeviuscula* Wood, 1842 – Marquet, p. 104, pl. 9, figs 7, 8.
1997 *Pyramidella plicosa* Bronn, 1838 – Marquet, p. 105, pl. 9, figs 5, 6.
1998 *Pyramidella laeviuscula* Wood, 1842 – Marquet, p. 188, pl. 9, fig. 160.
2001 *Pyramidella* (*Pyramidella*) *plicosa* Bronn, 1838 – Silva, p. 567, pl. 26, figs 13-15.
2005 *Pyramidella* (*Voluspa*) *plicosa* Brocchi, 1814 [sic] – Schnetler, p. 123, pl. 9, fig. 11.
2007 *Pyramidella* (*Voluspa*) *plicosa* Bronn, 1838 –

Wienrich, p. 753, pl. 129, figs 1, 2, pl. 163, figs 4, 5-7.
2008 *Pyramidella* (*Voluspa*) *plicosa* Bronn, 1838 – Moths & Tüxen, p. 119, pl. 15, fig. 7.
2008 *Pyramidella plicosa* (Bronn, 1838) – Chirli & Richard, p. 75, pl. 15, fig. 2.
2010 *Pyramidella* (*Voluspa*) *plicosa* Bronn, 1838 – Moths *et al*., p. 82, pl. 23, fig. 5.
2011 *Pyramidella plicosa* Bronn, 1838 – Chirli & Micali, p. 4, pl. 1, figs 6-8.
2013 *Pyramidella plicosa* Bronn, 1838 – Landau *et al*., p. 304, pl. 52, fig. 5.
2018 *Pyramidella plicosa* Bronn, 1838 – Brunetti & Cresti, p. 104, fig. 445.
2019 *Pyramidella plicosa* Bronn, 1838 – Cárdenas *et al*., p. 214, fig 8s.
2020 *Longchaeus plicosus* (Bronn, 1838) – Landau *et al*., p. 282, pl. 2, figs 1, 2.

non 1856 *Pyramidella plicosa* Bronn – Hörnes, p. 492, pl. 46, fig. 20 [= *Longchaeus unisulcatus* (Dujardin, 1837)].

Material and dimensions – Maximum height 9.5 mm, width 3.1 mm. **CO**: NHMW 2019/0167/0256 (21). **VC**: NHMW 2019/0167/0072 (1), NHMW 2019/0167/0462-0463 (2), NHMW 2019/0167/0073 (35). **VS**: NHMW 2019/0167/0815 (2). **EL**: NHMW 2019/0167/0426 (8).
var. *sublaeviuscula* Sacco, 1892: maximum height 9.8 mm, width 3.1 mm. **CO**: NHMW 2019/0167/0120 (8). **VC**: NHMW 2019/0167/0241 (16). **EL**: NHMW 2019/0167/0244 (16).

Discussion – *Longchaeus plicosus* (Bronn, 1838) is very variable in height, angle of the spire, angulation of the base, and strength of the three columellar folds. The depth of the suture is also highly variable; from deeply V-shaped (Pl. 8, fig. 6) to relatively superficial (Pl. 8, fig. 8). Sacco (1892a) gave varietal names to these forms, which are of no taxonomic value. The protoconch is of type B, deeply submerged into the apex of the teleoconch, so that little more than half of the protoconch is exposed (Estepona specimen; dp = 395 μm). The arguments for separating the North Sea Basin Pliocene species *Pyramidella laeviuscula* Wood, 1842 from *L. plicosus* given by Marquet (1997) are unconvincing, in our opinion, especially as the two forms are found together in the Belgian deposits.

Distribution – Lower Miocene: Proto-Mediterranean Sea (Burdigalian): Colli Torinesi, Italy (Sacco, 1892a; Zunino & Pavia, 2009). Lower-middle Miocene: North Sea Basin (late Burdigalian-Langhian): Belgium (Glibert, 1952), Bulgaria (Kojumdgieva & Strachimirov, 1960), Denmark (Ravn, 1907; Sorgenfrei, 1958), Germany (von Koenen, 1882; Anderson, 1964; Wienrich, 2007; Moths, 1989, Moths *et al*., 2010), Netherlands (Van Voorthuysen, 1944; Nordsieck, 1972a; A.W. Janssen, 1984). Middle Miocene: northeastern Atlantic (Langhian): Aquitaine Basin, France (Cossmann & Peyrot, 1917), (Langhian): Loire Basin, France (Glibert, 1949a); Paratethys (Langhian-Serravallian): Bulgaria (Kojumdgieva & Strachimirov, 1960), Hungary (Strausz, 1954, 1962, 1966), Poland (Friedberg, 1928), eastern Paratethys (Iljina, 1993); Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: North Sea Basin (Tortonian): Denmark (Schnetler, 2005; Moths & Tüxen, 2008); Atlantic (Tortonian and Messinian), NW France (Brébion, 1964; Landau *et al*., 2020), Spain (Cárdenas. *et al*, 2019); Proto-Mediterranean Sea (Tortonian): Po Basin, Italy (Sacco, 1892a). Lower Pliocene: North Sea Basin, England (Wood, 1842, 1848; Harmer, 1920), Belgium (Nyst, 1878, 1882; Glibert, 1958; Marquet, 1997, 1998); western Mediterranean, northeastern Spain, (Almera & Bofill, 1898; Almera, 1907; Martinell, 1982; Martinell & Domènech, 1982); central Mediterranean, Italy (Crovato & Micali, 1992b; Forli *et al*., 1999; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018), Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, England (Harmer, 1920), Belgium (Marquet, 1997, 1998); northeastern Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, S. Spain (this paper), Roussillon Basin, France (Chirli & Richard, 2008); central Mediterranean, Italy (Sacco, 1892a; Malatesta, 1974; Caprotti & Vescovi, 1973; Caprotti, 1976; Cavallo & Repetto, 1992). Upper Pliocene-Pleistocene: Atlantic, northwest France (Brébion, 1964). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914).

Subfamily Odostomiinae Pelseneer, 1928
Tribe Odostomiini Pelseneer, 1928
Genus *Auristomia* Monterosato, 1884

Type species (by subsequent designation, Crosse, 1885) – *Odostomia erjaveciana* Brusina, 1869, present-day, Adriatic.

1884 *Auristomia* Monterosato, p. 95.

Note – *Auristomia* species were characterised by Monterosato as "*Ci avviciniamo alle* Auriculinae *per la forma discendente degli anfratti ma di una sostanza più solida e senza scultura spirale, nè fissura ombelicale. Apertura proporzionalmente larga, auricolata. Piega appena visibile* [Similar to *Auriculinae* in having an oblique suture, but more solid, lacking spiral sculpture and umbilical chink. Aperture large, auriculate. Columellar fold barely detectable]" (Monterosato, 1884, p. 95).

***Auristomia erjaveciana* (Brusina, 1869)**
Plate 9, fig. 1

*1869 *Odostomia Erjaveciana* Brusina, p. 242.
1972b *Menestho tenuicula* Nordsieck, p. 105, pl. PIII, fig. 5 (*non O. tenuicola* Monterosato, 1878; see Van Aartsen & Menkhorst, 1996).
1972b *Odostomia* (*Auristomia*) *erjaveciana* Brusina, 1869 – Nordsieck, p. 114, pl. PIV, fig. 17.

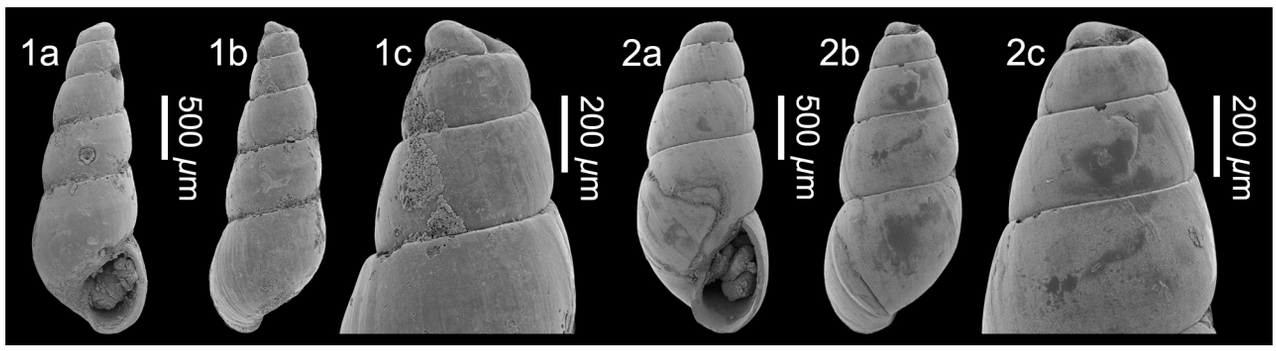

Plate 9. *Auristomia erjaveciana* (Brusina, 1869); 1. NHMW 2019/0167/0254, height 2.5 mm, width 880 μm, 1c, detail of protoconch. *Auristomia planatina* (Sacco, 1892); 2. NHMW 2019/0167/0254, height 2.3 mm, width 920 μm, 2c, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

1984 *Odostomia* (*Auristomia*) *erjaveciana* Brusina, 1869 – Van Aartsen *et al*., p. 53, fig. 251.
1987 *Odostomia* (*Auristomia*) *erjaveciana* Brusina – Van Aartsen, p. 16, 18, fig. 42.
1996 *Odostomia erjaveciana* Brusina, 1869 – Peñas *et al*., p. 44, fig. 101.
1996 *Odostomia* (*Auristomia*) *erjaveciana* Brusina, 1869 – Van Aartsen & Menkhorst, p. 54, fig. 16.
1998 *Odostomia erjaveciana* Brusina, 1869 – Wilke & Van Aartsen, p. 13, pl. 9, fig. 24a-c.
1999a *Odostomia erjaveciana* Brusina, 1869 – Peñas & Rolán, p. 106, figs 284-289.
2004 *Odostomia erjaveciana* (Brusina, 1869)[*sic*] – Solustri & Micali, p. 66, fig. 5g.
2011 *Odostomia erjaveciana* Brusina, 1869 – Hernández *et al*., p. 259, fig. 88Z.
2013 *Odostomia erjaveciana* Brusina, 1869 – Öztürk *et al*., p. 145, fig. 8.
2013 *Odostomia erjaveciana* Brusina, 1869 – Landau *et al*., p. 310, pl. 75, fig. 1.
2014 *Auristomia erjaveciana* (Brusina, 1869) – Giannuzzi-Savelli *et al*., p. 54, fig. 108, appendix p. 13, 60.
2014 *Odostomia erjaveciana* Brusina, 1869 – Peñas *et al*., p. 139, fig. 11H.
2018 *Auristomia erjaveciana* Brusina, 1869 [*sic*] – Trigo *et al*., p. 361, fig. 22.

Material and dimensions – Maximum height 2.5 mm, width 880 μm. **CO**: NHMW 2019/0167/0254 (1), NHMW 2019/0167/0255 (1).

Discussion – *Auristomia erjaveciana* (Brusina, 1869) is characterised by its solid shell, tall subcylindrical profile composed of weakly convex whorls, separated by a moderately impressed suture, orthocline to weakly prosocline growth lines, type C protoconch, inconspicuous columellar fold, and subobsolete umbilical chink. The extant Mediterranean *A. fusulus* (Monterosato, 1878) differs in being higher spired, more regularly conical in profile, with a more pointed apex, a shallower suture, a proportionately higher last whorl and aperture, and clearly prosocline growth lines.

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, northwestern Spain (Trigo *et al*., 2018), southern coast of Portugal south to Canary Islands (Peñas *et al*., 1996; Solustri & Micali, 2004; Peñas & Rolán, 1999a; Hernández *et al*., 2011), West Africa, Mauritania and Senegal (Peñas *et al*., 2014), western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013), Black Sea (Wilke & Van Aartsen, 1998).

***Auristomia planatina* (Sacco, 1892)**
Plate 9, fig. 2

*1892a *Odontostomia* (*Turritodostomia*) *plicata* var. *planatina* Sacco, p. 42, pl. 1, fig. 89.
1976 *Odostomia* (*Auristomia*) *planatina* (Sacco, 1892) – Pavia, p. 155, pl. 10, figs 1-2.
1992 *Odostomia* (*Auristomia*) *planatina* (Sacco, 1892) – Cavallo & Repetto, p. 158, fig. 447.
2011 *Odostomia planatina* (Sacco, 1892) – Chirli & Micali, p. 62, pl. 21, figs 1-5.
2018 *Auristomia planatina* (Sacco, 1892) – Brunetti & Cresti, p. 110, fig. 479.

Material and dimensions – Maximum height 2.3 mm, width 920 μm. **CO**: NHMW 2019/0167/0254 (1), NHMW 2019/0167/0255 (3). **VS**: NHMW 2019/0167/0443 (2).

Discussion – *Auristomia planatina* (Sacco, 1892) is characterised by its small squat pupoid shell, type B tending to C protoconch, teleoconch of 4-5 weakly convex whorls, separated by a weakly impressed suture, proscline growth lines, the last whorl is ovate, the base not delimited, imperforate, and the aperture pyriform, columella oblique, bearing weakly developed fold. Chirli & Micali (2011, p. 62) described the species as having very weak spiral sculpture. This is not seen in the Estepona

material, in which the protoconch is slightly more depressed. It differs from all the extant Mediterranean *Auristomia* species in its pupoid shell shape.

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992).

***Auristomia* sp.**
Plate 10, figs 1-3

Material and dimensions – Maximum height 2.7 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0688-0690 (3), NHMW 2019/0167/0691 (1).

Description – Shell small, tall conical. Protoconch type B tending to C. Teleoconch of five somewhat elevated convex whorls, with periphery below mid-whorl, separated by narrowly impressed, markedly oblique suture. Sculpture absent, except for straight, prosocline growth lines. Last whorl 52-55% total height, evenly rounded. Aperture ovate, columella oblique, without fold.

Discussion – The shell shape, strongly oblique suture, lack of spiral sculpture, and absence of columellar fold place this species in the genus *Auristomia* Monterosato, 1884. It is superficially similar to the extant West African *Odostomia digitulus* Peñas & Rolán, 1999 in shape and protoconch type, but that species has a less conical outline, less oblique suture, and it has a small but well-developed columellar fold. *Auristomia barashi* Bogi & Bella, 2000 described from Eastern Mediterranean has a stouter outline, more elevate protoconch, more convex whorls and higher last whorl (about 65% against 52-55%). *Auristomia fusulus* (Monterosato, 1878) is stouter, with flat whorls and superficial suture, creating a regularly conical outline and angulate periphery.

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

Genus *Brachystomia* Monterosato, 1884

Type species – *Odostomia rissoides* Hanley, 1844, by subsequent designation (Crosse, 1885), present-day, British Isles.

1884 *Brachystomia* Monterosato, p. 94.
1915 *Zastoma* Iredale, p. 336. Unnecessary *nom. nov. pro Brachystomia* Monterosato, 1884, treated by Iredale as a junior homonym of *Brachystoma* Gardner, 1876.

Note – *Brachystomia* species are characterised by their more or less convex whorls, rissoiform profile, plica instead of fold at the columella, and more or less elevated type B protoconch. Some authors include prosocline growth lines and microscopic spiral sculpture in the genus description (Graham, 1988, p. 544), but these are not present in all species presently included in the genus.

***Brachystomia angusta* (Jeffreys, 1867)**
Plate 11, figs 1-3

*1867 *Odostomia pallida* var. *angusta* Jeffreys, p. 125, pl. 6, fig. 22.
1972b *Odostomia* (*Brachystomia*) *ambigua* subsp. *angusta* Jeffreys, 1867 – Nordsieck, p. 111, pl. PIV, fig. 2a.
1980a *Odostomia angusta* Jeffreys, 1867 – Warén, p. 37, pl. 6, fig. 18 [not fig. 22 (Warén, *in litt*.)].
1987 *Odostomia angusta* Jeffreys, 1867 – Van Aartsen, p. 9, 13, fig. 23.
1996 *Odostomia angusta* Jeffreys, 1867 – Peñas *et al*., p. 40, figs 123-124.
2001 *Odostomia angusta* Jeffreys, 1867 – Cachia *et al*., p. 99, pl. 15, fig. 12.
2005 *Odostomia angusta* Jeffreys, 1867 – Rolán, p. 188, fig. 866.
2011 *Odostomia angusta* Jeffreys, 1867 – Chirli & Micali, p. 50, pl. 16, figs 12-15.
2011 *Odostomia angusta* Jeffreys, 1867 – Hernández *et al*., p. 258, figs 89A-B.

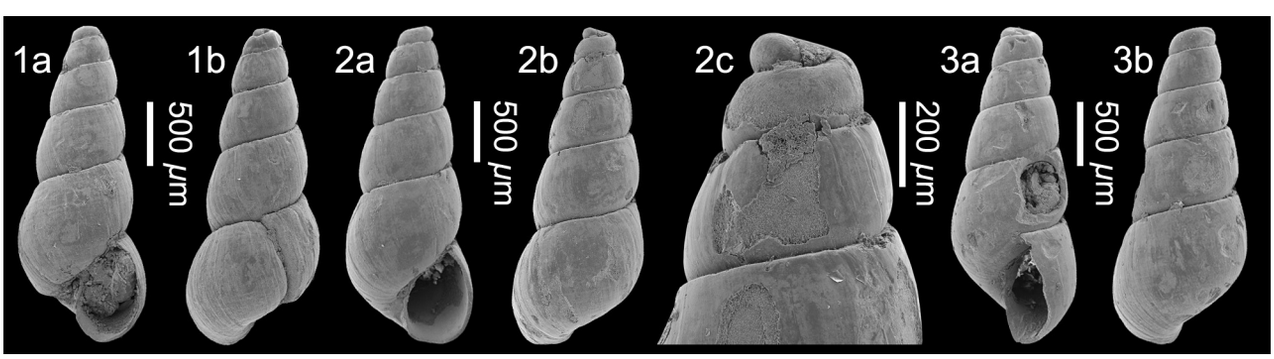

Plate 10. *Auristomia* sp.; 1. NHMW 2019/0167/0688, height 2.5 mm, width 965 μm; 2. NHMW 2019/0167/0689, height 2.7 mm, width 1.1 mm, 2c, detail of protoconch; 3. NHMW 2019/0167/0690, height 2.6 mm, width 1.0 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

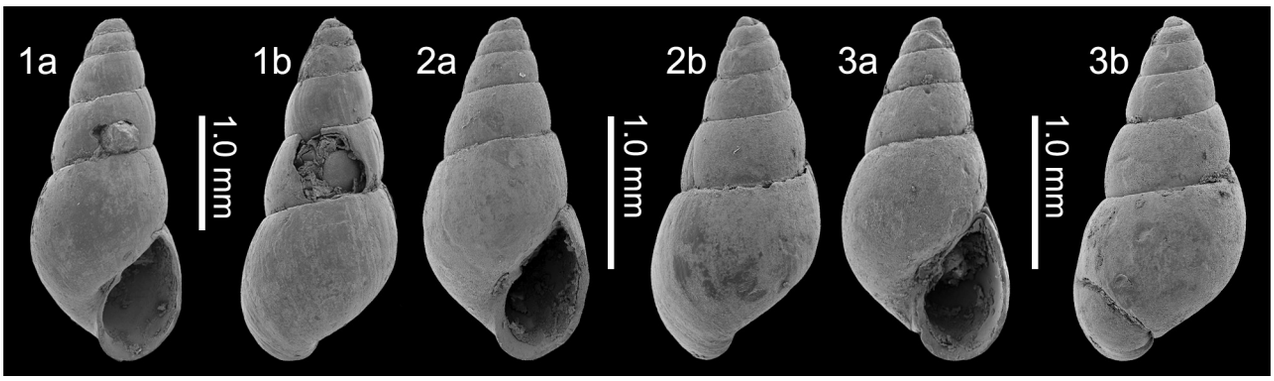

Plate 11. *Brachystomia angusta* (Jeffreys, 1867); 1. NHMW 2019/0167/0423, height 3.0 mm, width 1.3 mm; 2. NHMW 2019/0167/0623, height 2.3 mm, width 1.0 mm; 3. NHMW 2019/0167/0624, height 2.3 mm, width 1.0 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

2013 *Odostomia angusta* Jeffreys, 1867 – Öztürk *et al*., p. 142, fig. 3.
2014 *Odostomia angusta* Jeffreys, 1867– Giannuzzi-Savelli *et al*., p. 42, figs 45, 46, appendix p. 7, 54.
2018 *Brachystomia angusta* (Jeffreys, 1867) – Trigo *et al*., p. 361, fig. 18.

Material and dimensions – Maximum height 3.0 mm, width 1.3 mm. **EL**: NHMW 2019/0167/0423 (1), NHMW 2019/0167/0424 (1), NHMW 2019/0167/0623-0624 (10).

Discussion – *Brachystomia angusta* (Jeffreys, 1867) is characterised by its ovate-elongate profile, type B protoconch, teleoconch composed of up to five convex whorls, separated by a deeply impressed suture, orthocline, slightly flexuose growth lines, last whorl inflated, evenly and broadly convex, small umbilical chink, aperture pyriform, columella oblique, with a small fold placed mid-aperture. Peñas *et al.* (1996, p. 40) described weak spiral sculpture, also present in the Italian fossil specimen illustrated by Chirli & Micali (2011, pl. 16, fig. 14), but not evident in the Estepona material. However, the surface is somewhat abraded in the Spanish fossil shell.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, British Isles, northwestern Spain (Trigo *et al*., 2018), to West Africa, Mauritania (Van Aartsen *et al*., 1998), Canaries (Hernández *et al*., 2011) and Cape Verde Islands (Van Aartsen *et al*., 1998; Rolán, 2005), into western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean, (Öztürk *et al*., 2013).

Brachystomia eulimoides **(Hanley, 1844)**
Plate 12, figs 1-3

*1844 *Odostomia eulimoides* Hanley, p. 18.
1845 *Odostomia crassa* Thompson, p. 315, pl. 19, fig. 5.
1846 *Turbonilla oscitans* Lovén, p. 49, pl. 1, fig. 12.
1848 *Odostomia notata* Jeffreys, p. 336.
1848 *Odostomia dubia* Jeffreys, p. 338.
1865 *Odostomia Novegradensis* Brusina, p. 21.
1883b *Odostomia electa* Jeffreys, p. 394, pl. 44, fig. 3.
1920 *Odostomia eulimoides* Hanley – Harmer, p. 602, pl. 50, pl. 35.
1964 *Odostomia* (*Brachystomia*) *eulimoides* Hanley, 1844 – Van Regteren Altena *et al.*, p. 4, pl. 20, fig. 193.
1972b *Odostomia* (*Brachystomia*) *ambigua* subsp. *crassa* Thompson, 1845 – Nordsieck, p. 111, pl. PIV, fig. 2.
1972b *Odostomia* (*Brachystomia*) *ambigua novegradensis* Brusina, 1865 – Nordsieck, p. 111, pl. PIV, fig. 3.
1984 *Odostomia eulimoides* Hanley, 1844 – Van Aartsen *et al*., p. 53, fig. 252.
1987 *Odostomia eulimoides* Hanley, 1844 – Van Aartsen, p. 10, 14, figs 31, 32.
1988 *Brachystomia eulimoides* (Hanley, 1844) – Graham, p. 586, fig. 255.
1993 *Odostomia* (*Brachystomia*) *eulimoides* (Hanley, 1844) – Marquet, p. 94, pl. 4, figs 13, 14.
1996 *Odostomia eulimoides* Hanley, 1844 – Peñas *et al*., p. 44, figs 132-133.
1997 *Brachystomia eulimoides* (Hanley, 1844) – Marquet, p. 107.
1998 *Brachystomia eulimoides* (Hanley, 1844) – Marquet, p. 195, fig. 167.
1998 *Odostomia eulimoides* Hanley, 1844 – Wilke & Van Aartsen, p. 13, pl. 10, fig. 25a-c.
1999a *Odostomia eulimoides* Hanley, 1844 – Peñas & Rolán, p. 96, figs 255-259, 346, 347.
2001 *Odostomia eulimoides* Hanley, 1844 – Cachia *et al*., p. 101, pl. 16, fig. 3.
2004 *Odostomia eulimoides* (Hanley, 1844) [*sic*] – Solustri & Micali, p. 66, fig. 5h.
2011 *Odostomia eulimoides* Hanley, 1844 – Chirli & Micali, p. 59, pl. 19, figs 6-10 (*cum syn.*).
2011 *Odostomia eulimoides* Hanley, 1844 – Hernández *et al*., p. 259, fig. 88A".

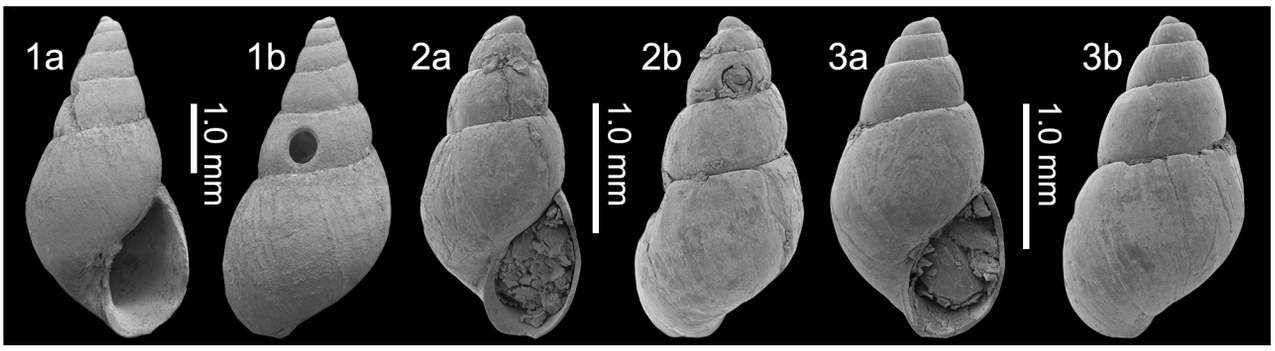

Plate 12. *Brachystomia eulimoides* (Hanley, 1844); 1. NHMW 2019/0167/0125, height 4.7 mm, width 2.3 mm. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0755, height 2.4 mm, width 1.2 mm; 3. NHMW 2019/0167/0756, height 2.2 mm, width 1.2mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

2013 *Odostomia eulimoides* Hanley, 1844 – Öztürk *et al*., p. 145, fig. 9.
2014 *Brachystomia eulimoides* Hanley, 1844 [*sic*] – Høisæter, p. 26, fig. 29.
2014 *Odostomia eulimoides* Hanley, 1844 – Giannuzzi-Savelli *et al*., p. 42, figs 50-52, appendix p. 7, 54.
2016 *Odostomia eulimoides* Hanley, 1844 – Bellagamba & Micali, p. 140, figs 3F, G.
2018 *Brachystomia eulimoides* (Hanley, 1844) – Trigo *et al*., p. 361, fig. 23.
2020 *Brachystomia eulimoides* (Hanley, 1844) – Raven, p. 43, fig. 55.

Material and dimensions – Maximum height 4.7 mm, width 2.3 mm. **CO**: NHMW 2019/0167/0125 (1), NHMW 2019/0167/0125 (1). **EL**: NHMW 2019/0167/0422 (8), NHMW 2019/0167/0755-0756 (2).

Discussion – *Brachystomia eulimoides* (Hanley, 1844) is characterised by its relatively large shell for the genus, type B protoconch tending to C, strongly depressed, inclined at angle of about 160°, teleoconch of 3-4 convex separated by deeply impressed suture, slightly scalate whorls, last whorl globose, rounded at base, with small umbilical chink, columella slightly thickened and erect abapically, bearing single prominent fold mid-height. The surface is smooth, apart from slightly prosocline growth lines. The specimens illustrated from the Velerín conglomerates (Pl. 12, figs 1-3) are fairly typical of the more inflated forms of the species (see Giannuzzi-Savelli *et al*., figs 51-52).

Distribution –Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: North Sea Basin: Oorderen and Kruisschans Sands, Belgium (Marquet, 1993, 1997, 1998); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Bellagamba & Micali, 2016). Lower Pleistocene: North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964); Atlantic, St. Erth, England (Harmer, 1920). Present-day: Atlantic, Scandinavia (Høisæter, 2014), North Sea (Raven, 2020), British Isles (Graham, 1988), northwestern Spain (Trigo *et al*., 2018), Canary Islands (Hernández *et al*., 2011), West Africa southwards to Angola (Peñas & Rolán, 1999a; Van Aartsen *et al*., 2000), into western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Solustri & Micali, 2004; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013), Black Sea (Wilke & Van Aartsen, 1998).

Brachystomia scalaris **(MacGillivray, 1843)**
Plate 13, figs 1-2

*1843 *Odostomia scalaris* MacGillivray, p. 154.
1844 *Odostomia rissoides* Hanley, p. 18.
1844 *Odostomia nitida* Alder, p. 326, pl. 8, fig. 5.
1848 *Odostomia eulimoides* var. *alba* Jeffreys, p. 337.
1867 *Odostomia rissoides* var. *exilis* Jeffreys, p. 123.
1923 *Odostomia rissoides* Hanley – Harmer, p. 834, pl. 64, figs 13, 14.
1984 *Odostomia scalaris* MacGillivray, 1843 – Van Aartsen *et al*., p. 53, fig. 254.
1986 *Brachystomia rissoides* (Hanley, 1844) – Fretter *et al*., p. 599, figs 412, 413.
1987 *Odostomia scalaris* MacGillivray, 1843 – Van Aartsen, p. 9, 12, fig. 22.
1988 *Brachystomia rissoides* (Hanley, 1844) – Graham, p. 584, figs 253 first fig. left, 254.
1996 *Odostomia scalaris* MacGillivray, 1843 – Peñas *et al*., p. 52, figs 136, 137.
1999a *Odostomia scalaris* MacGillivray, 1843 – Peñas & Rolán, p. 76, figs 191-207, 341, 342.
2001 *Odostomia scalaris* MacGillivray, 1843 – Cachia *et al*., p. 103, pl. 16, fig. 10.
2013 *Odostomia scalaris* MacGillivray, 1843 – Öztürk *et al*., p. 148, fig. 16.
2014 *Odostomia scalaris* MacGillivray, 1843 – Giannuzzi-Savelli *et al*., p. 468, figs 67, 68, appendix p. 9, 56.
2014 *Brachystomia scalaris* (MacGillivray, 1843) – Høisaeter, p. 27, figs 30-33.
2018 *Odostomia scalaris* MacGillivray, 1843 – Trigo *et al*., p. 362, fig. 27.
2020 *Brachystomia scalaris* (MacGillivray, 1843) – Raven, p. 43, fig. 56.

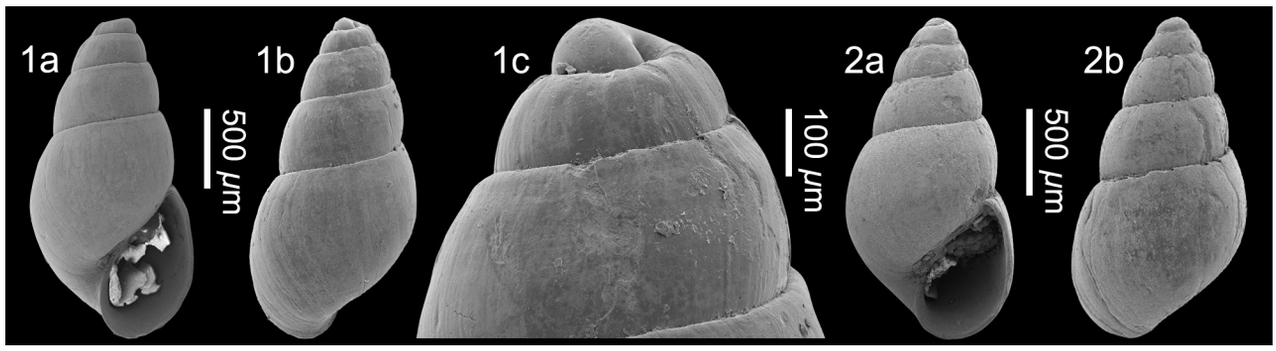

Plate 13. *Brachystomia scalaris* (MacGillivray, 1843); 1. NHMW 2019/0167/0614, height 2.0 mm, width 1.0 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0615, height 1.9 mm, width 990 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 2.3 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0614-0615 (2), NHMW 2019/0167/0616 (7).

Discussion – This species is characterised by its small shell, more or less elongated truncated conical profile, type B tending to C protoconch, teleoconch of up to four convex whorls separated by a deeply impressed suture, orthocline growth lines, ovate last whorl, very narrow umbilicus or imperforate, pyriform aperture, outer lip somewhat expanded abapically, weak to moderate strength columellar fold. The shell is highly variable, and West African specimens get larger the further south in their range, found sympatrically with smaller specimens (Peñas & Rolán, 1999a, p. 78). The Estepona specimens are rather small.
Brachystomia scalaris has seldom been recorded in the literature on fossils. Sacco (1892a, p. 41) recorded *Brachystomia rissoides* (Hanley, 1844) [= *B. scalaris* (MacGillivray, 1843)] from the upper Pliocene of Italy. However his figures are insufficient to confirm the identification. Crovato & Micali (1992b, p. 136) recorded *Odostomia* cf. *scalaris* from the lower Pliocene of Italy without figuring it. These Italian records are therefore excluded from the distribution. The only reliable fossil record is from the lower Pleistocene of England (Harmer, 1923).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1923). Present-day: European Atlantic from Norway (Høisaeter, 2014), North Sea (Raven, 2020), British Isles (Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), south to West Africa, Morocco, Canary Islands, Selvagens Islands (Nordsieck, & García-Talavera, 1979), Mauritania (Van Aartsen *et al*., 1998) to Angola (Peñas & Rolán, 1999a), into western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

Genus *Doliella* Monterosato, 1880

Type species – *Odostomia nitens* Jeffreys, 1870, by monotypy, present-day, Mediterranean.

1880 *Doliella* Monterosato, p. 73.

Note – Peñas & Rolán (1999a, p. 116) and Peñas *et al*. (2014, p. 144) used the genus *Odostomia* Fleming, 1813 in a broad sense, including *Odostomia nitens* Jeffreys, 1870 in that genus. However, the type species differs from *Odostomia* species in having an ovoid profile and lacking a columellar fold. We therefore follow Giannuzzi-Savelli *et al*. (2014) in recognising this genus.

***Doliella nitens* (Jeffreys, 1870)**
Plate 14, figs 1-2

*1870	*Odostomia nitens* Jeffreys, p. 79.
1887	*Oceanida ovalis* de Folin, p. 206, pl. 4, fig. 4.
1972b	*Odostomia* (*Doliella*) *nitens* Jeffreys, 1870 – Nordsieck, p. 114, pl. PIV, fig. 11.
1987	*Odostomia* (*Doliella*) *nitens* Jeffreys, 1870 – Van Aartsen, p. 6, fig. 4.
1996	*Odostomia nitens* Jeffreys, 1870 – Peñas *et al*., figs 94, 95.
1999a	*Odostomia nitens* Jeffreys, 1870 – Peñas & Rolán, p. 116, fig. 355.
2001	*Odostomia nitens* Jeffreys, 1870 – Cachia *et al*., p. 103, pl. 16, fig. 8.
2011	*Odostomia nitens* Jeffreys, 1870 – Hernández *et al*., p. 261, fig. 89K.
2014	*Doliella nitens* (Jeffreys, 1879) – Giannuzzi-Savelli *et al*., p. 58, fig. 129, appendix p. 15, 62.

Material and dimensions – Maximum height 2.8 mm, width 1.0 mm. **EL**: NHMW 2019/0167/0678-0679 (2), NHMW 2019/0167/0680 (22).

Discussion – With its pupoid profile, type C protoconch, slightly convex whorls separated by a superficial suture, prosocline growth lines and small regularly ovoid aper-

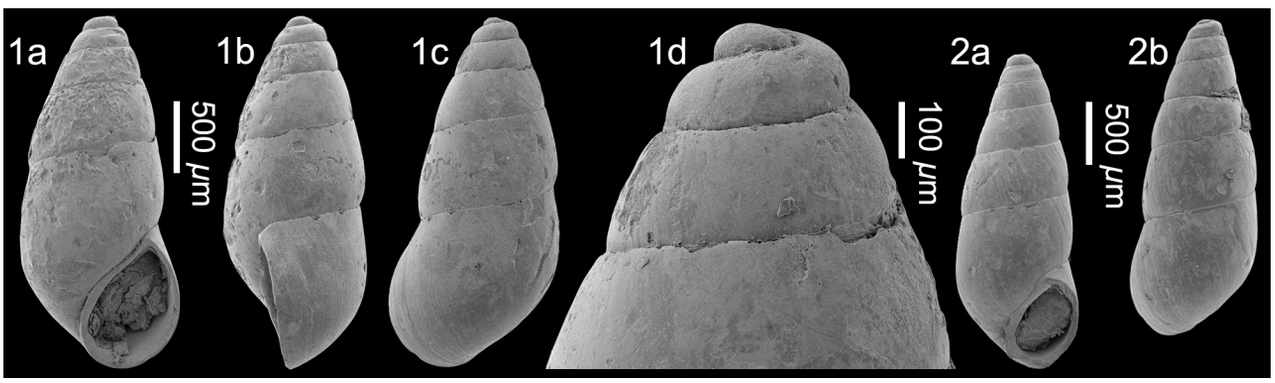

Plate 14. *Doliella nitens* (Jeffreys, 1879); 1. NHMW 2019/0167/0678, height 2.5 mm, width 1.1 mm, 1d, detail of protoconch; 2. NHMW 2019/0167/0679, height 2.5 mm, width 980 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

ture without a columellar fold, *Doliella nitens* (Jeffreys, 1879) cannot be confused with any other species. These fossil specimens are a little slenderer than present-day ones. As far as we are aware, this is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: European Atlantic Ireland to Spain (Nordsieck, 1972b; Peñas & Rolán, 1999a), Azores (Nordsieck, 1972b; Van Aartsen *et al*., 1998), Canaries (Van Aartsen *et al*., 1998; Hernández *et al*., 2011; Peñas *et al*., 2014) and West Africa, Cape Verde Islands (Van Aartsen *et al*., 1998), central Mediterranean (Van Aartsen, 1987; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

Genus *Liostomia* Sars, 1878

Type species – *Turbonilla clavula* Lovén, 1846, by subsequent designation (Monterosato, 1884), present-day, Sweden.

1878 *Liostomia* Sars, p. 205.
1915 *Cremula* Iredale, p. 336. Type species (by typification of replaced name): *Turbonilla clavula* Lovén, 1846, present-day, Sweden. Unnecessary *nom. nov. pro Liostomia* G.O. Sars, 1878, by Iredale regarded as a junior homonym of *Leiostoma* Swainson, 1840.

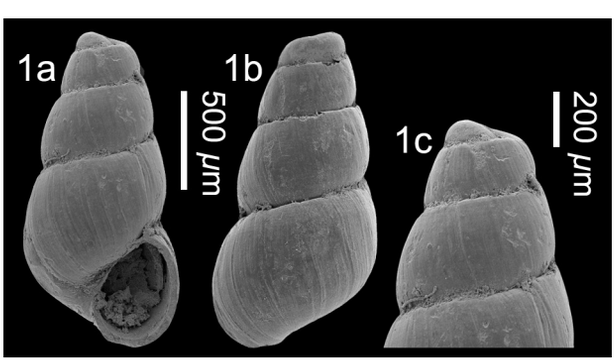

Plate 15. *Liostomia afzelii* Warén, 1991; 1. NHMW 2019/0167/0464, height 1.6 mm, width 785 μm, 1c, detail of protoconch (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Note – *Liostomia* Sars, 1878 species are characterised by their small size, ovate to short conical profile, protoconch usually of type C, lack of spiral sculpture, and smooth columellar lip, which in gerontic specimens may bear a very weak fold. The molecular phylogeny of Schander *et al*. (2003) identified a Liostomini clade in which *Liostomia* was a sister group to *Parthenina*. This is unexpected based on shell morphology. However, this finding was disputed by Dinapoli *et al.* (2010).

***Liostomia afzelii* Warén, 1991**
Plate 15, fig. 1

1878 *Liostomia clavula* Lovén – Sars, p. 207, pl. 7, fig. 13 [*non Liostomia clavula* (Lovén, 1846)].
1987 *Odostomia* (*Liostomia*) *clavula* (Lovén, 1846) – Van Aartsen (*partim*), p. 6, fig. 6 only [*non Liostomia clavula* (Lovén, 1846)].
*1991 *Liostomia afzelii* Warén, p. 106, figs 35A-B, 36A.
1996 *Odostomia afzelii* (Warén, 1991) – Peñas *et al*., p. 40, fig. 97.
2001 *Liostomia afzelii* Warén, 1991 – Cachia *et al*., p. 105, pl. 17, fig. 4.
2004 *Liostomia afzelii* (Warén, 1991) [*sic*] – Solustri & Micali, p. 65, fig. 4a.
2013 *Liostomia afzelii* Warén, 1991 – Öztürk *et al*., p. 151, fig. 22.
2014 *Liostomia afzelii* Warén, 1991 – Høisæter, p. 51, figs 84, 89.
2014 *Liostomia afzelii* Warén, 1991 – Giannuzzi-Savelli *et al*., p. 54, fig. 111, appendix p. 13, 60.

Material and dimensions – Maximum height 1.6 mm, width 785 μm. **VS**: NHMW 2019/0167/0464 (1), NHMW 2019/0167/0465 (1).

Discussion – *Liostomia afzelii* Warén, 1991 is characterised by its small, truncated cylindrical shell, flattened type C protoconch, teleoconch of up to 3.5 convex whorls, smooth, except for slightly prosocline growth lines, convex last whorl, the base not delimited, bearing a well-developed, deep umbilical chink, and columella without a fold. This species is most similar to *L. clavula* (Lovén, 1846), which is slenderer with a greater number of whorls. Moreover, the molecular analysis of Schander *et al.* (2003) suggests that they are separate species. This is the first fossil record for *L. afzelii*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic Norway (Høisæter, 2014), British Isles (Warén, 1991), into western Mediterranean (Warén, 1991; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Solustri & Micali, 2004; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

***Liostomia clavula* (Lovén, 1846)**
Plate 16, figs 1-2

*1846	*Turbonilla clavula* Lovén, p. 49.
1873	*Odostomia pistillus* Brugnone, p. 3 [*non Syrnola pistillum* A. Adams, 1863]
1874	*Odostomia Brugnoni* Monterosato, p. 266 [*nom nov. pro Odostomia pistillus* Brugnone, 1873, *non Syrnola pistillum* A. Adams, 1863].
1876	*Odostomia pistilliformis* Brugnone, p. 24 [*nom nov. pro Odostomia pistillus* Brugnone, 1873, *non Syrnola* (?*Odostomia*) *pistillum* A. Adams, 1863].
1986	*Liostomia clavula* (Lovén, 1846) – Fretter *et al*., p. 587, figs 402-404.
1987	*Odostomia* (*Liostomia*) *clavula* (Lovén, 1846) – Van Aartsen (*partim*), p. 6, fig. 7 only (not fig 6 = *Liostomia afzelii* Warén, 1991).
1988	*Liostomia clavula* (Lovén, 1846) – Graham, p. 574, fig. 248.
1991	*Liostomia clavula* (Lovén, 1846) – Warén, p. 106, figs 35C, D, G..
1996	*Odostomia clavulus* (Lovén, 1846) – Peñas *et al*., p. 42, fig. 96.
1999a	*Odostomia clavulus* (Lovén, 1846) – Peñas & Rolán, p. 116, figs 309, 310.
2001	*Liostomia clavulus* [sic] (Lovén, 1846) – Cachia *et al*., p. 106, pl. 17, fig. 5.
2013	*Liostomia clavula* (Lovén, 1846) – Öztürk *et al*., p. 151, fig. 23.
2014	*Liostomia clavula* (Lovén, 1846) – Høisæter, p. 51, figs 85, 89.
2014	*Liostomia clavula* (Lovén, 1846) – Giannuzzi-Savelli *et al*., p. 54, fig. 112, appendix p. 13, 61.
2016	*Liostomia clavula* (Lovén, 1846) – Bellagamba & Micali, p. 140, fig. 3H, I
2018	*Liostomia clavula* (Lovén, 1846) – Trigo *et al*., p. 362, fig. 31.

Material and dimensions – Maximum height 1.6 mm, width 695 μm. **EL**: NHMW 2019/0167/0773-0774 (2).

Discussion – *Liostomia clavula* (Lovén, 1846) is characterised by its small, elongated, truncated subcylindrical shell, large flattened type C protoconch, teleoconch of up to four convex whorls separated by deeply impressed suture, smooth, except for orthocline growth lines, convex last whorl, the base not delimited, bearing a well-developed, deep umbilical chink, and columella without a fold. This species is most similar to *L. afzelii* Warén, 1991, which is less slender with fewer whorls. As noted under *L. afzelii*, the molecular analysis of Schander *et al.* (2003) suggests that they are separate species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Bellagamba & Micali, 2016). Present-day: Atlantic Norway (Høisæter, 2014), British Isles (Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), south to Canary Islands, and West Africa, Mauritania, Senegal to Angola (Peñas & Rolán, 1999a), into western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

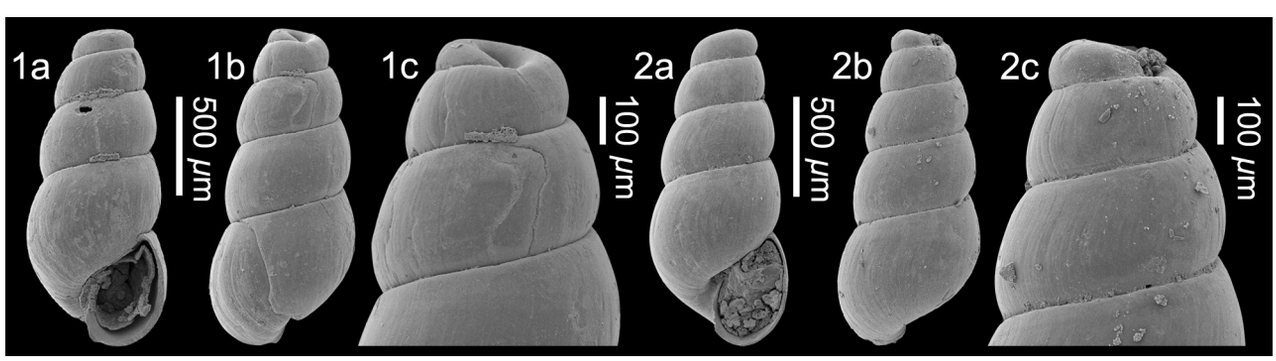

Plate 16. *Liostomia clavula* (Lovén, 1846); 1. NHMW 2019/0167/0773, height 1.5 mm, width 685 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0774, height 1.6 mm, width 695 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

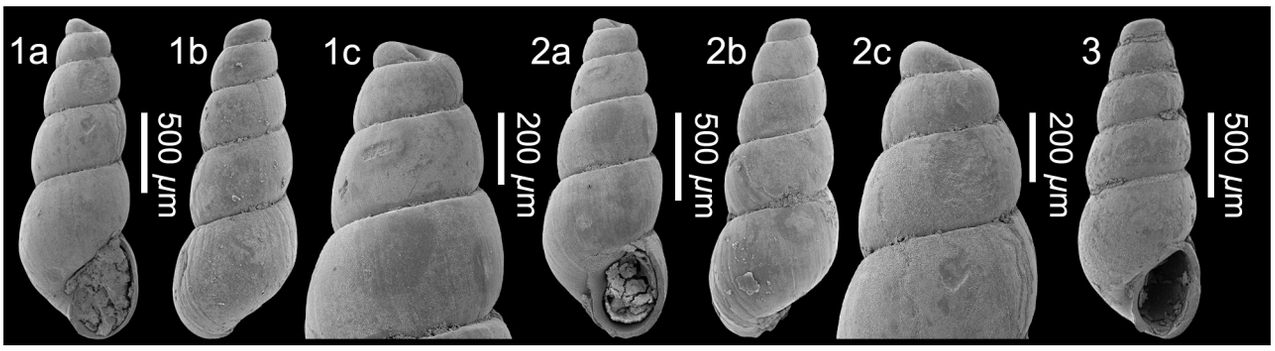

Plate 17. *Liostomia wareni* Schander, 1994; 1. NHMW 2019/0167/0768, height 2.0 mm, width 750 µm, 1c, detail of protoconch; 2. NHMW 2019/0167/0769, height 1.8 mm, width 695 µm, 2c, detail of protoconch. El Lobillo. 3. NHMW 2019/0167/0631, height 1.9 mm, width 710 µm (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Liostomia wareni* Schander, 1994**
Plate 17, figs 1-3

*1994	*Liostomia wareni* Schander, p. 33, figs 4f, 11f, g.
1998	*Odostomia* (*Odostomia*) *vanurki* Van Aartsen, Gittenberger & Goud, p. 33, fig. 35.
1999a	*Odostomia wareni* (Schander, 1999) – Peñas & Rolán, p. 114, figs 302-305.
2014	*Odostomia wareni* (Schander, 1999) – Peñas *et al*., p. 152, fig. 16E.

Material and dimensions – Maximum height 2.0 mm, width 750 µm. **VS**: NHMW 2019/0167/0631 (1), NHMW 2019/0167/0632 (1). **EL**: NHMW 2019/0167/0768-0769 (2).

Discussion – *Liostomia wareni* Schander, 1994 is characterised by its solid cylindrical shell, type B tending to C protoconch, teleoconch of four evenly convex whorls separated by a deeply impressed suture, prosocline growth lines, ovate aperture, and no fold, but a weak adapical columellar thickening. Two extremely similar species from West Africa were described differing in not having a columellar fold, *Liostomia wareni* Schander, 1994, or a weak fold, *Odostomia* (*Odostomia*) *vanurki* Van Aartsen, Gittenberger & Goud, 1998. Peñas & Rolán (1999a) re-examined the type material and concluded that a fold was not really present in *O. vanurki*, but a thickening of the columella, and synonymised the two.

Distribution – Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0274); western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Senegal (Schander, 1994), Ghana, São Tomé and Príncipe, Cape Verde Islands (Peñas & Rolán, 1999a), Guinea Conakry (Peñas *et al*., 2014).

***Liostomia wilvanderstoelae* nov. sp.**
Plate 18, figs 1-2

Type material – Holotype NHMW 2019/0167/0269, height 1.6 mm, width 960 µm; paratype 1, NHMW 2019/0167/0270, height 1.7 mm, width 1.1 mm.

Other material – Maximum height 1.7 mm, width 1.1 mm. **VC**: NHMW 2019/0167/0271 (2).

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

Type stratum – lower Piacenzian, upper Pliocene.

Etymology – Named after Wilhelmina Maria van der Stoel, in recognition of her tireless patience whilst her

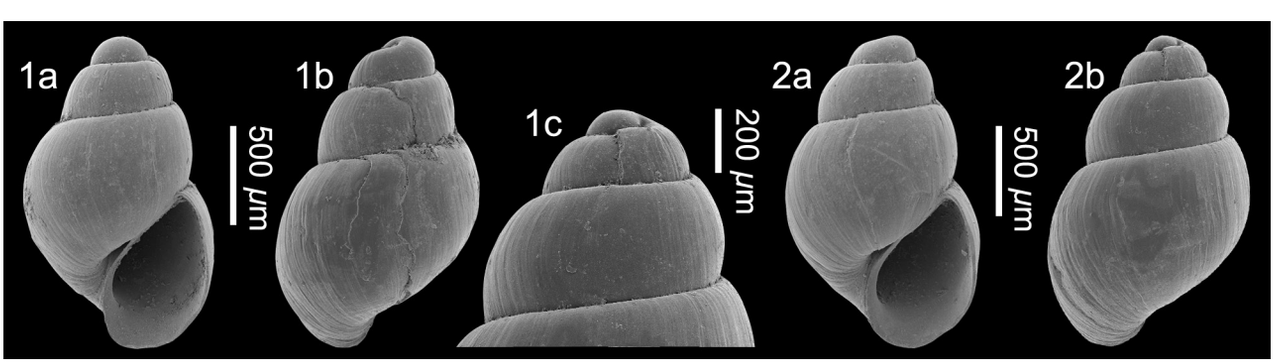

Plate 18. *Liostomia wilvanderstoelae* nov. sp.; 1. **Holotype** NHMW 2019/0167/0269, height 1.6 mm, width 960 µm, 1c, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0270, height 1.7 mm, width 1.1 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

husband, Henk Mulder, collected and sorted pyramidellids for this monograph. *Liostomia* gender feminine.

Diagnosis – *Liostomia* species of minute size, ovate-globular profile, type C protoconch, strongly convex teleoconch whorls, orthocline growth lines, well-developed umbilical chink, and no columellar fold.

Description – Shell minute, rather ovate-globular profile, with depressed spire. Protoconch type C. Teleoconch of three strongly convex whorls separated by a deeply impressed suture, orthocline growth lines. Last whorl strongly and evenly convex, base not delimited, well developed umbilical chink present. Aperture broad pyriform, outer lip rounded, moderately flared abapically. Columella without a fold. Columellar callus detached abapically forming medial border of umbilical chink.

Discussion – *Liostomia wilvanderstoelae* nov. sp. is similar to *L. mamoi* Mifsud, 1993 from the present-day Atlantic of Madeira to the Canary Islands and Mediterranean, but differs in having a more elongated ovate profile, orthocline rather than strongly prosocline growth lines, the umbilical chink is narrower and the aperture more elongate. It is also similar to the present-day Atlantic and Mediterranean *L. hansgei* Warén, 1991, but that species is slightly taller spired, less globose, lacks an umbilicus, and has a smaller aperture. *Odostomia nardoi* Brusina, 1869 from the present-day Mediterranean also has a globose shell, but is immediately separated by having a strong columellar fold and a more depressed protoconch.

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

Genus *Macrodostomia* Sacco, 1892

Type species – *Odontostomia* (*Macrodostomia*) *bismichaelis* Sacco, 1892, by subsequent designation (Cossmann & Peyrot, 1917), Pliocene, Italy.

1892a *Macrodostomia* Sacco, p. 43.
1921 *Macrodontostomia* Cossmann, p. 233. Unjustified emendation of *Macrodostomia* Sacco, 1892

Note – *Macrodostomia* Sacco, 1892 species are characterised by their fusiform to subconical shape, flattenened whorls separated by a relatively weakly impressed suture, elongate aperture, weak columellar tooth placed below mid-whorl and smooth surface (Cossmann, 1921, p. 233). This genus has been synonymised with *Auristomia* Monterosato, 1884 (type species *Odostomia erjaveciana* Brusina, 1869, by subsequent designation, Crosse, 1885, present-day, Mediterranean) by some authors (Cavallo & Repetto, 1992; Ferrero *et al*., 1998), but that genus differs in having smaller, more fragile shells that are less solid, and a more strongly intorted protoconch. In most species the columellar fold is even weaker than in *Macrodostomia*. We have not encountered any species attributable to this genus in the present-day European or West African faunas and agree with Cossmann & Peyrot (1921) that the genus is probably extinct.

***Macrodostomia bismichaelis* (Sacco, 1892)**
Plate 19 figs 1-2

1876 *Odostomia Michaelis* Brugnone, p. 24, pl. 1, fig. 33.
*1892a *Odontostomia* (*Macrodostomia*) *bismichaelis* Sacco, p. 43 (*nom. nov. pro Odostomia michaelis* Brugnone, 1876, *non* Brugnone, 1873).
1892a *Odontostomia* (*Macrodostomia*) *bismichaelis* var. *turritellina* Sacco, p. 43, pl. 1, fig. 93 *bis*.
1892a *Odontostomia* (*Macrodostomia*) *bismichaelis* var. *mutinensis* Sacco, p. 43, pl. 1, fig. 93 *ter*.
1984 *Odontostomia* (*Macrodostomia*) *bismichaelis* var. *turritellina* Sacco, 1892 – Ferrero Mortara *et al*., p. 74, pl. 10, fig. 2.
1987 *Odostomia michaelis* Brugnone, 1876 – Gaglini, p. 9, fig. 24.
1992 *Odostomia* (*Auristomia*) *bismichaelis* Sacco, 1892 – Cavallo & Repetto, p. 158, fig. 446.
1998 *Odontostomia bismichaelis* Sacco, 1892 – Bogi & Cauli, p. 130, fig. 7.
1998 *Odostomia* (*Auristomia*) *bismichaelis* Sacco – Ferrero *et al*., p. 49, pl. 2, fig. 4.
2011 *Eulimella pyramidata* (Deshayes, 1835) – Chirli & Micali, p. 13, pl. 3, figs 6-9 (*non Ptycheulimella pyramidata* (Deshayes, 1835).
2011 *Odostomia bismichaelis* (Sacco, 1892) – Chirli & Micali, p. 51, pl. 17, figs 6-10 (*cum syn*.).
2019 *Syrnola subumbilicatoides* (Sacco, 1892) – Cárdenas *et al*., p. 214, fig. 8u (*non* Sacco, 1892).

Material and dimensions – Maximum height 4.7 mm, width 1.6 mm. **CO**: NHMW 2019/0167/0252 (4). **VC**: NHMW 2019/0167/0124 (21), NHMW 2019/0167/0489 (1). **EL**: NHMW 2019/0167/0429 (3). **PQ**: NHMW 2019/0167/0067 (1).

Discussion – Sacco (1892a, p. 43) wrote: "*Il Brugnone nel 1873* (Miscell. malac. *I, pag. 7, fig. 7) istituì un'* Odostomia Michaelis *che forse deve solo considerarsi come una varietà di* 0. planulata Jan. *Di ciò accortosi il Brugnone volle dare il nome di* Michaelis *ad un'altra forma* [Brugnone, 1876, p. 24]*, ciò che non credo ammissibile, per cui indico quest'ultima col nome di* bismichaelis. *La figura del Brugnone non è troppo buona, ed anzi venne corretta colla descrizione dallo stesso Autore* [Brugnone erected in 1873 (*Miscell. malac*. I, pag. 7, fig. 7) *Odostomia Michaelis*, which should probably be considered a variety of *O. planulata* De Cristofori & Jan, 1832. Once Brugnone became aware of this, he gave the name *Michaelis* to another species [Brugnone, 1876, p. 24], which I believe is unacceptable, so I propose the name *bismichaelis* for the second one. The figure in Brugnone is not so good, and was corrected by the same Author in

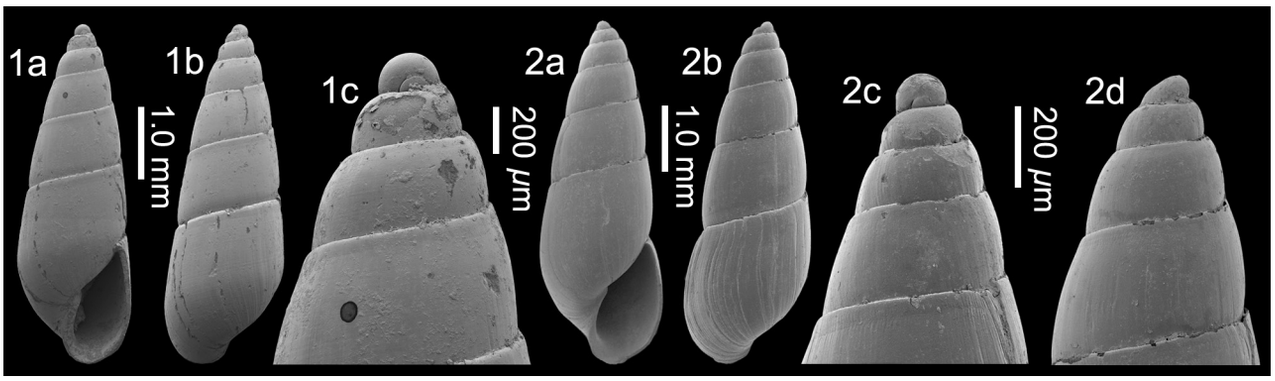

Plate 19. *Macrodostomia bismichaelis* (Sacco, 1892); 1. NHMW 2019/0167/0067, height 4.7 mm, width 1.6 mm, 1c, detail of protoconch. Parque Antena. 2. NHMW 2019/0167/0489, height 5.2 mm, width 1.9 mm, 2c-d, detail of protoconch (SEM images), Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

his description]". We agree with Sacco's interpretation, and therefore:

Odostomia michaelis Brugnone, 1873 =? *Pyramidella planulata* De Cristofori & Jan, 1832. It is a 9.5 mm high shell that could be conspecific with *P. planulata*.
Odontostomia (*Macrodostomia*) *bismichaelis* Sacco, 1892 is a *nom. nov. pro Odostomia michaelis* Brugnone, 1876, *non Odostomia michaelis* Brugnone, 1873, primary homonym.

Macrodostomia bismichaelis (Sacco, 1892) is characterised by its relatively slender shape, small B type protoconch (Estepona specimen; dp = 250 μm), teleoconch of up to six tall, weakly convex whorls, separated by an impressed suture, but not deeply so, last whorl tall and slender, evenly convex, columellar callus weakly developed bearing single weak tooth below mid-aperture. Surface smooth, except for orthocline growth lines. The species is somewhat variable in slenderness (see Chirli & Micali, 2011, pl. 17, figs 6-10). The specimen figured from Parque Antena (Pl. 19, fig. 1) is typical of the slenderer form.

Distribution – Upper Miocene: Atlantic, southern Spain (Cárdenas *et al*., 2019); central Proto-Mediterranean, Italy (Sacco, 1892a). Lower Pliocene: central Mediterranean, Italy (Guioli *et al*., 2009; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984; Cavallo & Repetto, 1992; Bogi & Cauli, 1998; Ferrero *et al*., 1998).

***Macrodostomia conicoastensis* (Sacco, 1892)**
Plate 20, fig. 1

*1892a *Odontostomia* (*Macrodostomia*) *conicoastensis* Sacco, p. 45, pl. 1, fig. 99.

Material and dimensions – Maximum height 7.8 mm, width 2.9 mm. **CO**: NHMW 2019/0167/0752 (1).

Discussion – This species is characterised by its tall conical profile, type B protoconch (Estepona specimen; dp = 270 μm, tilted at 130° to main shell axis), convex early whorls, later whorls flat-sided, last whorl relatively broad and strongly convex at the base, and moderately well developed columellar fold. *Macrodostomia subangulatina* (Sacco, 1892) is slenderer, with a narrower last whorl. *Macrodostomia bismichaelis* (Sacco, 1892) and *M. submichaelis* (Sacco, 1892) have the angulation on the last whorl placed higher and are more fusiform in profile.

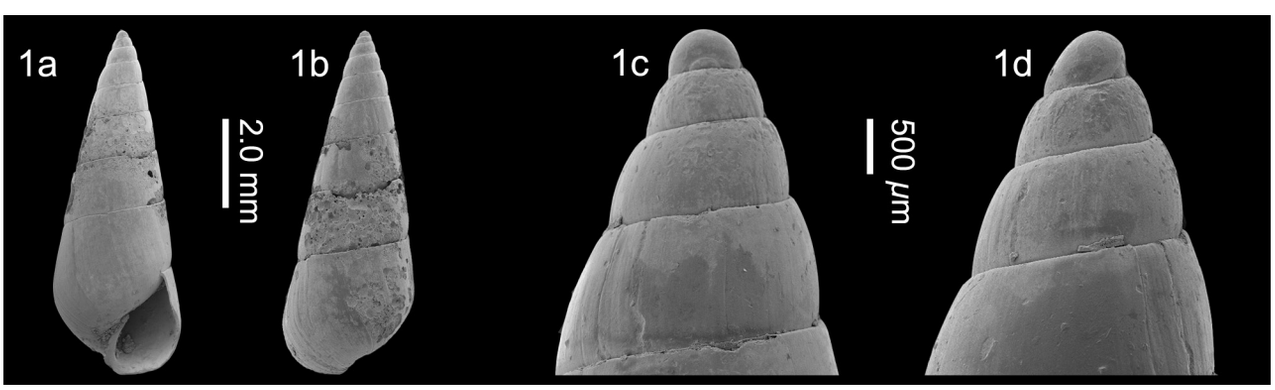

Plate 20. *Macrodostomia conicoastensis* (Sacco, 1892); 1. NHMW 2019/0167/0752, height 7.8 mm, width 2.9 mm, 1c-d, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Macrodostomia suturalis (Sacco, 1892) has more convex late teleoconch whorls.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a).

***Macrodostomia subangulatina* (Sacco, 1892)**
Plate 21, figs 1-2

1892a *Odontostomia* (*Macrodostomia*) *submichaelis* var. *subangulatina* Sacco, p. 44, pl. 1, fig. 95.

Material and dimensions – Maximum height 5.2 mm, width 1.8 mm. **CO**: NHMW 2019/0167/0499-0500 (2), NHMW 2019/0167/0591 (1). **VS**: NHMW 2019/0167/0814 (6).

Discussion – This species is characterised by its solid shell, relatively tall and narrow regularly conical spire, type B protoconch, with only half the nucleus exposed (dp = 520 μm, tilted at 130° to main shell axis), teleoconch of six whorls, first whorl convex, abapically whorls rapidly flat-sided, separated by a superficial, linear suture, growth lines slightly prosocline, last whorl tall, 47% total height, weakly angled at periphery, base rounded, imperforate, aperture pyriform, outer lip moderately flared abapically, columella straight, bearing broad, weak fold at its adapical end.
The specimens correspond with *Odontostomia* (*Macrodostomia*) *submichaelis* var. *subangulatina* Sacco, 1892. It was said to differ from the nominal species in having a more regularly conical spire and a more angular base. However, it is unlikely that this is simply a slender, taller spired morphotype of *Macrodostomia submichaelis* (Sacco, 1892), which also occurs in the Estepona assemblages (see below), as the protoconch is double the size (dp = 265 μm for *M. submichaelis*). The growth rate of the early whorls is much greater in *M. submichaelis*, giving the early teleoconch whorls a cyrtoconoid profile, rather than the regularly conical spire seen in *M. subangulatina*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Sacco, 1892a).

***Macrodostomia submichaelis* (Sacco, 1892)**
Plate 22, figs 1-3

*1892a *Odontostomia* (*Macrodostomia*) *submichaelis* Sacco, p. 43, pl. 1, fig. 94.
1892a *Odontostomia* (*Macrodostomia*) *submichaelis* var. *persuturata* Sacco, p. 44, pl. 1, fig. 96.
1892a *Odontostomia* (*Macrodostomia*) *submichaelis* var. *transiens* Sacco, p. 44, pl. 1, fig. 97.
1892a *Odontostomia* (*Macrodostomia*) *submichaelis* var. *turritastensis* Sacco, p. 44, pl. 1, fig. 98.
1984 *Odontostomia* (*Macrodostomia*) *submichaelis* Sacco, 1892 – Ferrero Mortara *et al*., p. 74, pl. 10, fig. 9.
2004 *Odostomia* (*Auristomia*) cf. *fusulata* Sacco, 1892 – Repetto & Lacroce, p. 194, pl. 1, fig. 8.
2004 *Odostomia* (*Auristomia*) *michaelis* Brugnone, 1876 – Repetto & Lacroce, p. 194, pl. 1, fig. 9 [*non Odostomia michaelis* Brugnone, 1873 =? *Pyramidella planulata* De Cristofori & Jan, 1832].

Material and dimensions – Maximum height 5.9 mm, width 2.3 mm. **CO**: NHMW 2019/0167/0251 (27). **VC**: NHMW 2019/0167/0134 (20), NHMW 2019/0167/0490 (1). **PQ**: NHMW 2019/0167/0093 (1), NHMW 2019/0167/0094 (3). *M. submichaelis* var. *transiens* (Sacco, 1892). **CO**: NHMW 2019/0167/0492 (1), NHMW 2019/0167/0493 (5). **EL**: NHMW 2019/0167/0686 (1).

Discussion – *Macrodostomia submichaelis* (Sacco, 1892) is characterised by its conical spire, the early whorls cyrtoconoid in profile, the whorls separated by a weakly impressed suture, type B protoconch (Estepona specimen; dp = 265 μm, tilted at 130-135° to main shell axis), and subangular base. The columellar callus is short, thickened and erect abapically and bears a small fold at its abapical end. Parietal callus is not developed. It differs from *M. bismichaelis* (Sacco, 1892) in having a more wider-angled,

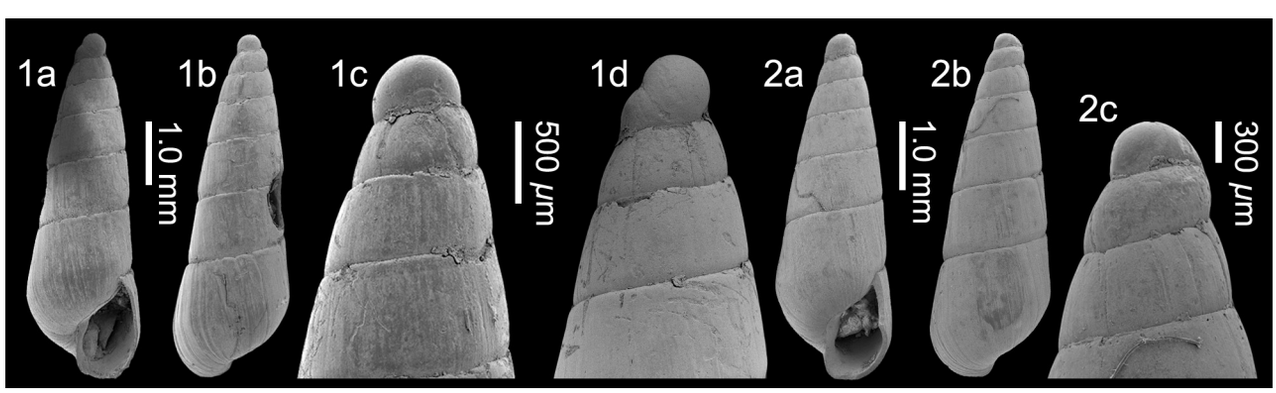

Plate 21. *Macrodostomia subangulatina* (Sacco, 1892); 1. NHMW 2019/0167/0499, height 4.5 mm, width 1.8 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0500, height 5.2 mm, width 1.8 mm, 2c, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

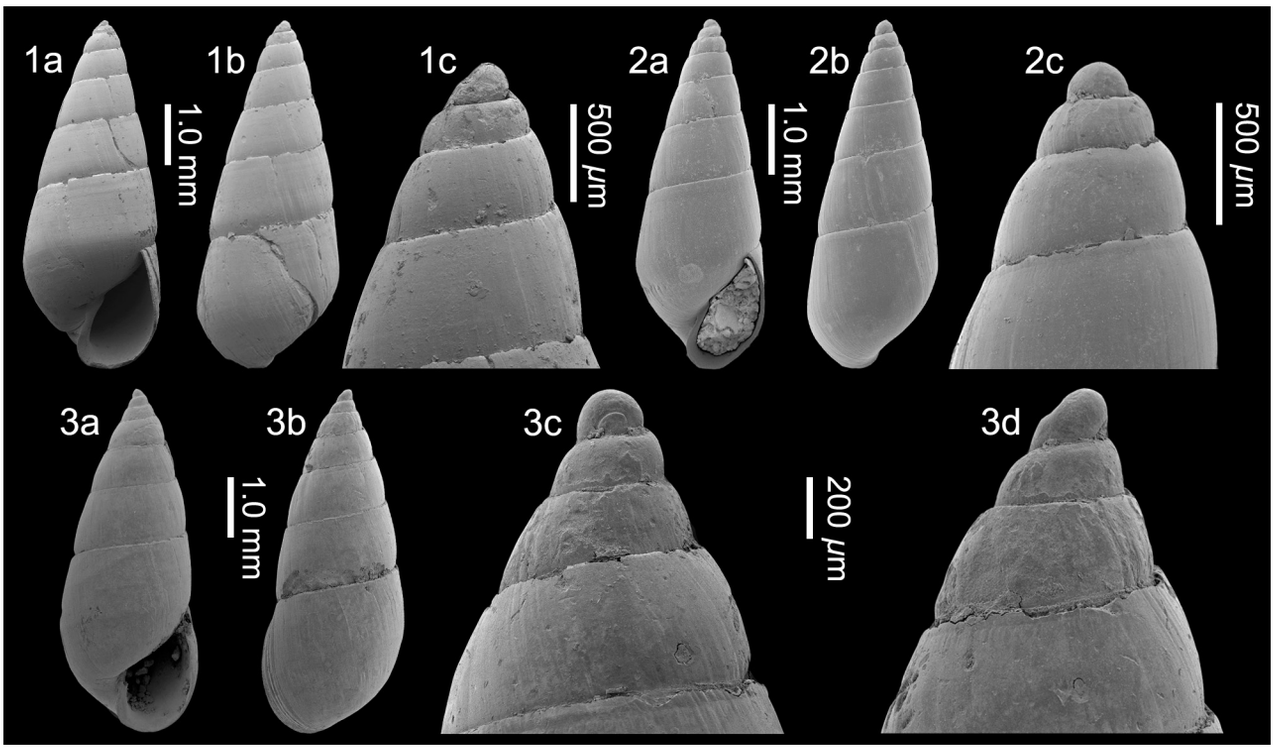

Plate 22. *Macrodostomia submichaelis* (Sacco, 1892); 1. NHMW 2019/0167/0093, height 5.9 mm, width 2.3 mm, 1c, detail of protoconch. Parque Antena. 2. NHMW 2019/0167/0490, height 5.0 mm, width 1.8 mm, 2c, detail of protoconch, Velerín carretera. *Macrodostomia submichaelis* 'var. *transiens*' (Sacco, 1892); 3. NHMW 2019/0167/0492, height 5.9 mm, width 2.3 mm, 3c-d, detail of protoconch (SEM images), Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

regularly conical spire, the suture is not as deeply impressed, and the base is subangular. Some specimens have a more ovate shell and the the last whorl is less angular at the base, approximating in profile to *M. bismichaelis* (Sacco, 1892), but not as slender. This form was named *Macrodostomia submichaelis* var. *transiens* (Sacco, 1892), and a specimen figured here (Pl. 22, fig. 3) has a slightly smaller protoconch (Estepona specimen; dp = 220 μm) than the typical form, but this fits within the variability for the species. The protoconchs of Italian specimens from Tuscany and Rio Torsero have similar measurements (dp = 225-250 μm, hp = 125-145 μm; PM unpublished data). According to Sacco (1892a, p. 45), *Macrodostomia submichaelis* (Sacco, 1892) differs from *M. bismichaelis* (Sacco, 1892) in having a more regularly conical spire composed of flatter whorls, in having the last whorl weakly angled at the base, causing the aperture to be less ovate. *Macrodostomia wrigleyi* (Glibert, 1949) from the middle and upper Miocene of NW France, differs in having a taller cyrtoconoid spire, as opposed to the regularly conical spire seen in *M. submichaelis*, the suture is more deeply impressed and the base even less angular.

Distribution – Upper Miocene: central Proto-Mediterranean, Italy (Sacco, 1892a). Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Repetto & Lacroce, 2004). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984).

***Macrodostomia suturalis* (Sacco, 1892)**
Plate 23, figs 1-2

*1892a	*Odontostomia (Macrodostomia) suturalis* (Bon.) Sacco, p. 45, pl. 1, fig. 100.
2011	*Odostomia suturalis* (Sacco, 1892) – Chirli & Micali, p. 62, pl. 21, figs 6-11.

Material and dimensions – Maximum height 5.0 mm, width 2.0 mm. **EL**: NHMW 2019/0167/0534-0535 (2). **VC**: NHMW 2019/0167/0470 (1).

Revised description – Shell conical, relatively elongate and broad. Protoconch type A1 tending to B, just over two whorls, with the nucleus completely exposed (dp = 400-410 μm, hp = 350-370 μm, dn = 70-85 μm, tilted at 115-125° to main shell axis). Teleoconch of up to five convex whorls, separated by moderately impressed, linear suture. Growth lines slightly flexuous, orthocline to weakly prosocline, sometimes raised making surface slightly rugose. Last whorl moderately inflated, 53% total height, rounded at periphery. Aperture pyriform, 32% total height, outer lip convex, weakly flared abapically. Columella slightly thickened, almost vertical, fold reduced to slight thickening at adapical end of columella.

Discussion – These specimens seem to be conspecific with those from the Italian Pliocene described and illus-

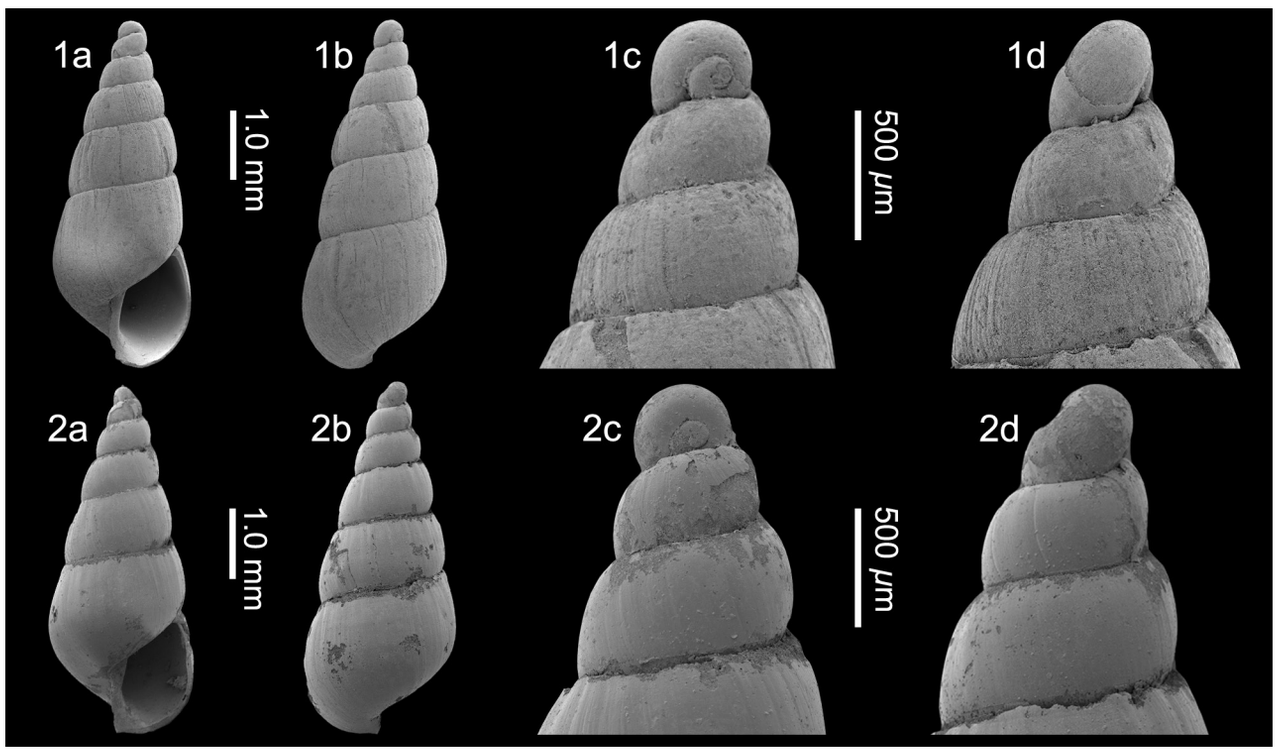

Plate 23. *Macrodostomia suturalis* (Sacco, 1892); 1. NHMW 2019/0167/0534, height 5.0 mm, width 2.0 mm, 1c-d, detail of protoconch. El Lobillo. 2. NHMW 2019/0167/0470, height 5.0 mm, width 1.9 mm, 2c-d, detail of protoconch (SEM images). Velerín Carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

trated by Chirli & Micali (2011, p. 62, pl. 21, figs 6-11) as *Odostomia suturalis* (Sacco, 1892). Those authors noted an atypical character described as "*strie di accrescimento prosocline, talvolta più marcate, che danno alla superficie un aspetto leggermente rugoso* [growth lines prosocline, sometimes more marked, that make the surface slightly rough]." (Chirli & Micali, 2011, p. 63). This character can also be seen in the Estepona specimens.
Macrodostomia suturalis is separated from its Estepona congeners *M. bismichaelis* (Sacco, 1892), *M. submichaelis* (Sacco, 1892) and *M. syrnoleoides* (Sacco, 1892) in having a larger, less intorted, less tilted protoconch, with the nucleus completely exposed, and in having more convex teleoconch whorls. The columellar fold, which is weak in all members of the genus, is reduced further to a slight thickening of the columella at its abapical end.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0286); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a).

***Macrodostomia syrnoleoides* (Sacco, 1892)**
Plate 24, figs 1-3

*1892a *Odontostomia* (*Macrodostomia*) *syrnoleoides* Sacco, p. 45, pl. 1, fig. 100 *bis*.

1984 *Odontostomia* (*Macrodostomia*) *syrnoleoides* Sacco, 1892 – Ferrero Mortara *et al*., p. 75, pl. 9, fig. 9.

Material and dimensions – Maximum height 7.8 mm, width 2.9 mm. **CO**: NHMW 2019/0167/0068-0069 (2), 2019/0167/0491 (24), NHMW 2019/0167/0869 (1). **VC**: NHMW 2019/0167/0300 (5). **EL**: NHMW 2019/0167/0428 (12).

Discussion – The holotype of *Macrodostomia syrnoleoides* (Sacco, 1892) was refigured by Ferrero Mortara *et al*. (1984, pl. 9, fig. 9). It is most similar to *M. bismichaelis* (Sacco, 1892), from which it differs in being higher-spired and in having the last whorl more rounded at the base. It differs from *Macrodostomia submichaelis* (Sacco, 1892) in being higher-spired, with a cyrtoconoid profile of the initial spire whorls, orthocline instead of prosocline growth lines and more rounded base. The difference in outline is more evident in large specimens (compare Ferrero Mortara *et al*., pl. 9, fig. 9 against pl. 10, fig. 9). The protoconch type is of type B (Estepona specimen; dp = 270 μm, tilted at 130° to main shell axis). All of the above *Macrodostomia* species; *M. bismichaelis*, *M. conicoastensis*, *M. submichaelis* and *M. syrnoleoides* are closely similar and have the same type of relatively small type B protoconch, deeply submerged in the apical teleoconch whorl, with half or less of the nucleus exposed.

Distribution – Upper Pliocene: western Mediterranean,

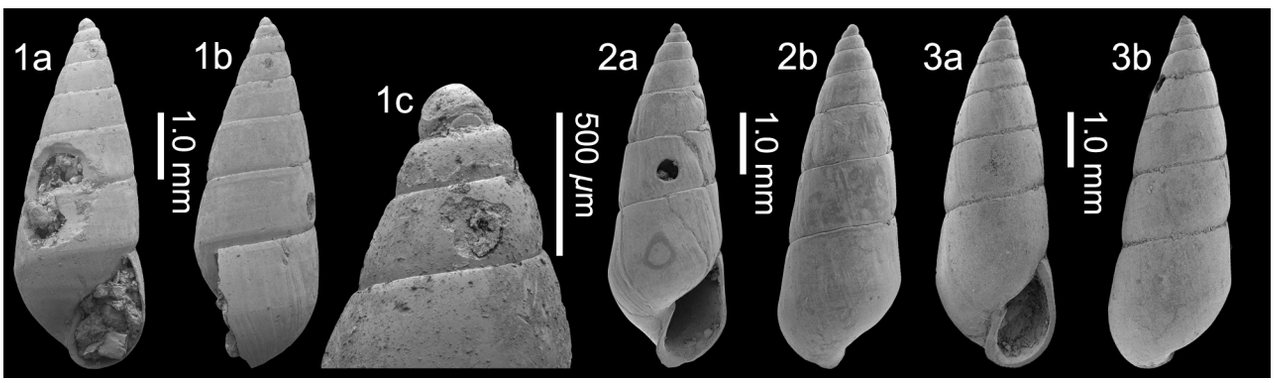

Plate 24. *Macrodostomia syrnoleoides* (Sacco, 1892); 1. NHMW 2019/0167/0068, height 7.8 mm, width 2.9 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0069, height 5.6 mm, width 1.9 mm; 2. NHMW 2019/0167/0869, height 6.4 mm, width 2.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984).

Genus *Megastomia* Monterosato, 1884

Type species – *Odostomia conspicua* Alder, 1850, by original designation, present-day, British Isles, Europe.

1884	*Megastomia* Monterosato, p. 94.
1904	*Stomega* Dall & Bartsch, p. 13. Type species (by typification of replaced name): *Odostomia conspicua* Alder, 1850, British Isles, Europe. Established as a *nom. nov. pro. Megastomia* Monterosato, 1884, with the same type species, suggesting Dall & Bartsch considered it a junior homonym of *Megastoma* Swainson, 1837 [Aves].
1921	*Somatomega* Cossmann, p. 241. Suggested alternative spelling for *Stomega* Dall & Bartsch, 1904. Not available.

Note – *Megastomia* Monterosato, 1884 differs from *Odostomia* Fleming, 1813 in having a series of well developed, elongated lirae within the outer lip (Schander, 1994; Peñas & Rolán, 1999a).

***Megastomia alungata* (Nordsieck, 1972)**
Plate 25, figs 1-2

?1914	*Odontostomia acuta* Jeffr. – Cerulli-Irelli (*partim*), p. 254 [428], pl. 22 [54], fig. 37 only (*non O. acuta* Jeffreys, 1848).
*1972b	*Odostomia* (*Megastomia*) *conspicua alungata* Nordsieck, p. 108, PIII, fig. 17.
1985a	*Odostomia* (*Megastomia*) *conspicua alungata* Nordsieck, 1972 – Micali, p. 32, fig. 3.
2011	*Odostomia conspicua alungata* Nordsieck, 1972 – Chirli & Micali, p. 58, pl. 18, figs 11-13, 15 only [fig. 14 = *Megastomia conspicua* (Alder, 1850)].
2014	*Megastomia alungata* (Nordsieck, 1972) – Giannuzzi-Savelli *et al*., p. 56, figs 117-118, appendix p. 13, 61.
2016	*Megastomia alungata* (Nordsieck, 1972) – Bellagamba & Micali, p. 140, figs 3J, K.
2020	*Megastomia alungata* (Nordsieck, 1972) – Landau *et al*., p. 287, pl. 8, fig. 1.

Material and dimensions – Maximum height 3.0 mm, width 1.4 mm. **CO**: NHMW 2019/0167/0137 (1), NHMW 2019/0167/0138 (3). **VC**: NHMW 2019/0167/0136 (10), NHMW 2019/0167/0542 (1). **EL**: NHMW 2019/0167/0559 (50+), NHMW 2019/0167/0626 (1).

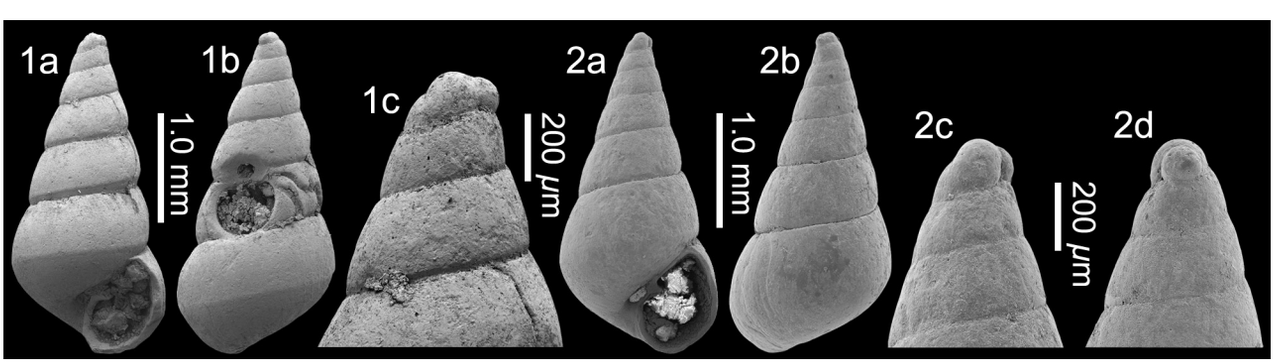

Plate 25. *Megastomia alungata* (Nordsieck, 1972); 1. NHMW 2019/0167/0137, height 3.0 mm, width 1.4 mm, 1c, detail of protoconch. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0626, height 2.8 mm, width 1.4 mm, 2c-d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Megastomia alungata* (Nordsieck, 1972) is characterised by its conical shape, type A2 helicoid protoconch, prosocline growth lines (barely detectable in Pl. 25, fig. 1a only), angular last whorl, relatively broad and deep umbilicus, and its sharp, well-developed columellar fold. It differs from *M. conspicua* (Alder, 1850) in being smaller (2.8-3.0 mm vs. 4.0-5.0 mm, up to 9.0 mm for *M. conspicua*) and in having a smaller protoconch (diameter ~ 175 μm vs. ~ 225 μm) (Giannuzzi-Savelli *et al*., p. 13, 61). One of the specimens from Estepona (Pl. 25, fig. 2) has an even smaller protoconch (dp = 167 μm) that we consider to fit within the intraspecific variability for *M. alungata*. Chirli & Micali (2011, p. 58) recognised both species in the lower Pliocene Mediterranean of Tuscany, Italy, and they also occur together in the upper Pliocene of the Estepona Basin, southern Spain. Landau *et al*. (2020, p. 287) recorded this species from the upper Miocene Tortonian of NW France, suggesting a greater geographic range for the species during the upper Miocene, as Pliocene to present-day records are restricted to the Mediterranean (see Peñas & Rolán, 1999a, p. 18).

Distribution – Upper Miocene: Atlantic (Tortonian and Messinian), NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0285); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Bellagamba & Micali, 2016). ?Lower Pleistocene, central Mediterranean, Italy (Cerulli-Irelli, 1914). Present-day: Mediterranean, Ibiza, Corsica (Nordsieck, 1972b; Giannuzzi-Savelli *et al*., 2014).

***Megastomia aplicangulata* (Sacco, 1892)**
Plate 26, figs 1-2

*1892a	*Odontostomia aplicangulata*	Sacco, p. 36, pl. 1, fig. 72.
1984	*Odontostomia aplicangulata*	Sacco, 1892 – Ferrero Mortara *et al*., p. 72, pl. 10, fig. 1.
2011	*Odostomia aplicangulata*	(Sacco, 1892) – Chirli & Micali, p. 51, pl. 17, figs 1-5.
2011	*Odostomia aplicangulata*	(Sacco, 1892) – Chirli & Linse, p. 201, pl. 77, fig. 1.

Material and dimensions – Maximum height 4.5 mm, width 2.1 mm. **CO**: NHMW 2019/0167/0139 (1), NHMW 2019/0167/0140 (31). **VC**: NHMW 2019/0167/0141 (50+), NHMW 2019/0167/0480-0481 (2). **EL**: NHMW 2019/0167/0119 (33). **VS**: NHMW 2019/0167/0860 (2).

Discussion – *Megastomia aplicangulata* (Sacco, 1892) is characterised by its broad conical spire, type B protoconch intorted at about 160°, with the nucleus completely obscured, teleoconch composed of up to six weakly convex whorls, separated by a moderately deep suture, orthocline growth lines, an angular to subangular last whorl, weakly carinate in some specimens, rounded base, very small, narrow umbilical chink, outer lip weakly lirate within, and sharp columellar fold. It is closely similar to *M. conoidea* (Brocchi, 1814), with which it co-occurs in the Estepona assemblages, but differs primarily in having a B-type protoconch, whereas *M. conoidea* has an A2 type protoconch. It also has a weaker, more acute columellar fold than *M. conoidea*. The lirations within the outer lip also seem weaker on average than in *M. conoidea*, although this feature is variable in both species. As seen in the series illustrated, the angulation of the last whorl is also variable. It is also closely similar to *Odostomia duureni* Van Aartsen, Gittenberger & Goud, 1998 from the present-day Azores, which has the same type of protoconch and profile, but in that species the growth lines are prosocline, the columellar part of the inner lip is straight instead of curved, and there is no trace of lirae within the outer lip, placing it in the genus *Odostomia* rather than *Megastomia*. *Megastomia desmiti* (Van Aartsen, Gittenberger & Goud, 1998) from Mauritania is extremely similar in profile, type B protoconch and apertural features, and might me a synonym. However, that species has a single spiral line around the periphery that is not clearly seen in the illustration of the holotype (Van Aartsen *et al*., 1998, fig. 38) and we can find no further illustrations of the species. Therefore we provisionally refrain from synonymising the two.

Distribution – Lower Pliocene: central Mediterranean,

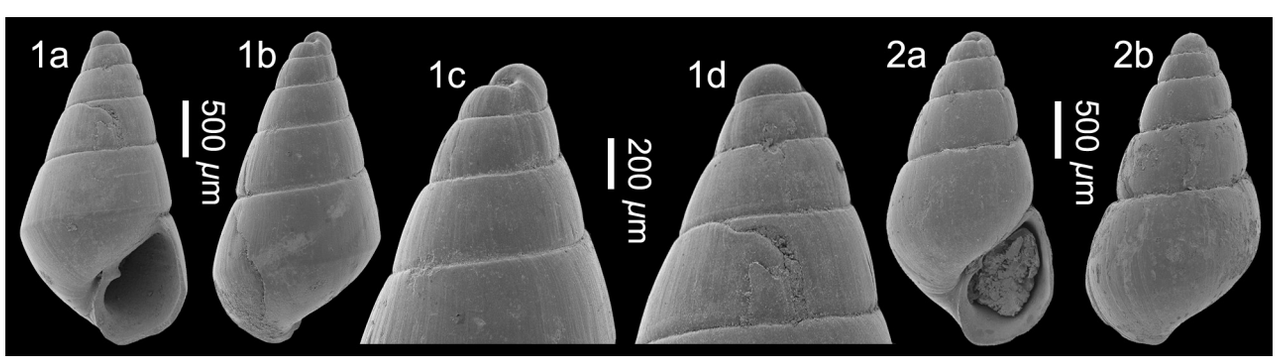

Plate 26. *Megastomia aplicangulata* (Sacco, 1892); 1. NHMW 2019/0167/0480, height 2.8 mm, width 1.4 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0481, height 2.7 mm, width 1.5 mm (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984; Ferrero *et al*., 2005).

***Megastomia conoidea* (Brocchi, 1814)**
Plate 27, figs 1-2

*1814 *Turbo conoideus* Brocchi, p. 660, pl. 16, fig. 2.
1832 *Ovatella polita* Ant. Bivona, p. 59, pl. 1, fig. 7, pl. 2, fig. 11.
1867 *Odostomia conoidea* var. *australis* Jeffreys, p. 128, pl. 6, fig. 27.
1878 *Odontostomia conoidea* Brocchi – Nyst, pl. 6, fig. 2.
1881 *Odontostomia conoidea* Brocchi – Nyst, p. 71.
1882 *Odostomia conoïdea* Brocchi – Bucquoy *et al*., p. 159, pl. 21, figs 1-3.
1884 *Odostomia tenuis* Jeffreys, Jeffreys, p. 347, pl. 26, fig. 4 (*non* Carpenter, 1857).
1892a *Odontostomia conoidea* var. *Sismondae* (Seg.) – Sacco, p. 615, pl. 1, fig. 66.
1892a *Odontostomia conoidea* var. *triangulatoides* Sacco, p. 616, pl. 1, fig. 67.
1892a *Odontostomia conoidea* var. *infundibuloides* Sacco, p. 616, pl. 1, fig. 68.
1892a *Odontostomia conoidea* var. *perconoidalis* Sacco, p. 617, pl. 1, fig. 69.
1892a *Odontostomia conoidea* var. *magniumbilicata* Sacco, p. 617, pl. 1, fig. 70.
?1903 *Odontostomia conoidea* Brocchi – Dollfus *et al*., p. 14, pl. 34, fig. 1.
1903 *Odontostomia pallidaeformis* Sacco – Dollfus *et al*., p. 14, pl. 34, fig. 2.
1904 *Odontostomia conoidea* (Br.) – Sacco, p. 108, pl. 24, fig. 7.
1904 *Odontostomia conoidea* var. *explicata* Sacc., Sacco, p. 108, pl. 1, fig. 8.
1914 *Odontostomia conoidea* Br. – Cerulli-Irelli, p. 252 [426], pl. 22 [54], figs 14-17.
1920 *Odostomia conoidea* (Brocchi) – Harmer, p. 599, pl. 50, fig. 33.
1928 *Odontostomia conoidea* Brocc. – Friedberg, p. 447, pl. 27, fig. 14.
1955 *Odostomia* (*Megastomia*) *conoidea* (Brocchi) 1814 – Rossi Ronchetti, p. 152, figs 77, 77a.
1960 *Odostomia* (*Megastomia*) *conoidea* (Brocchi 1814) – Kojumdgieva & Strachimirov, p. 97, pl. 30, fig. 7.
1960 *Odostomia* (*Megastomia*) *conoidea* (Brocchi) – Pelosio, p. 148, pl. 2, fig. 2.
1963 *Odostomia* (*Megastomia*) *conoidea* (Brocchi 1814) – Venzo & Pelosio, p. 77, pl. 34, figs 20-22.
1964 *Odostomia* (*Megastomia*) *conoidea* Brocchi, 1814 – Brébion, p. 286, pl. 7, figs 10, 11.
1969 *Odostomia conoidea* (Brocchi.) – Fekih, p. 13, pl. 1, fig. 10.
1972b *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Nordsieck, p. 108, pl. PIII, fig. 18.
?1974 *Odostomia* (*Megastomia*) *conoidea* (Brocchi), 1814 – Caprotti, p. 36, pl. 4, fig. 4.
1976 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Pavia, p. 158, pl. 10, figs 9-13.
1978 *Turbo conoideus* Brocchi, 1814 – Pinna & Spezia, p. 162, 53, fig. 4.
1982 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Martinell, p. 224, pl. 1, figs 3-4.
1985a *Odostomia conoidea* (Brocchi, 1814) – Micali, p. 31, fig. 4.
1986 *Odostomia conoidea* (Brocchi, 1814) – Fretter *et al*., p. 616, figs 427-428.
1987 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Cuerda Barceló, p. 327, pl. 30, fig. 11.
1987 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Van Aartsen, p. 7, 10, fig. 12.
1988 *Odostomia conoidea* (Brocchi, 1814) – Graham, p. 600, figs 261, 258, 252/2.
1992 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Cavallo & Repetto, p. 160, fig. 454.
1993 *Odostomia* (*O.*) *conoidea* (Brocchi, 1814) – Marquet, p. 94, pl. 4, figs 9, 10.
1997 *Odostomia conoidea* (Brocchi) – Ruiz Muñoz *et al*., p. 186, pl. 40, figs 15, 16.
1998 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Van Aartsen *et al*., p. 33, fig. 36.
1998 *Odostomia* (*Megastomia*) cfr. *conoidea* (Brocchi, 1814) – Marquet, p. 199, fig. 171.
1999a *Odostomia conoidea* (Brocchi, 1814) – Peñas & Rolán, p. 26, figs 53-60, 91, 92.
2001 *Odostomia conoidea* (Brocchi, 1814) – Cachia *et al*., p. 100, pl. 16, fig. 1.
2001 *Odostomia* (*Megastomia*) ex gr. *conoidea* (Brocchi, 1814) – Silva, p. 570, pl. 26, figs 18-21.
2003 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – İslamoğlu & Taner, p. 45, pl. 2, fig. 15.
2004 *Odostomia conoidea* (Brocchi, 1814) – Solustri & Micali, p. 66, fig. 5f.
2005 *Odostomia* (*Megastomia*) *conoidea* (Brocchi) – Ferrero *et al*., p. 94, 96, pl. 1, fig. 4.
2005 *Megastomia conoidea* (Brocchi, 1814) – Rolán, p. 183, fig. 856.
2008 *Odostomia conoidea* (Brocchi, 1814) – Chirli & Richard, p. 76, pl. 15, figs 4, 5.
2010 *Odostomia conoidea* (Brocchi, 1814) – Sosso & Dell'Angelo, p. 52, unnumbered fig. p. 67, top second from right.
2011 *Megastomia conoidea* (Brocchi, 1814) – Landau *et al*., p. 40, pl. 22, fig. 6.
2011 *Odostomia conoidea* (Brocchi, 1814) – Chirli & Micali, p. 53, pl. 18, figs 1-7 (*cum syn*.).
2011 *Odostomia conoidea* (Brocchi, 1814) – Chirli & Linse, p. 201, pl. 77, fig. 2.
2011 *Megastomia conoidea* (Brocchi, 1814) – Hernández *et al*., p. 257, figs 88N-P.
2013 *Megastomia conoidea* (Brocchi, 1814) – Landau *et al*., p. 308, pl. 74, fig. 12 (*cum syn*.).
2013 *Odostomia conoidea* (Brocchi, 1814) – Öztürk *et al*., p. 143, fig. 6A-D.
2013 *Odostomia conoidea* (Brocchi, 1814) – Bellagam-

ba *et al*., p. 122, fig. 2O.

2014 *Megastomia conoidea* (Brocchi, 1814) – Giannuzzi-Savelli *et al*., p. 56, figs 119-126, appendix p. 14, 61.

2016 *Megastomia conoidea* (Brocchi, 1814) – **Bella**-gamba & Micali, p. 140, fig. 3L.

2018 *Megastomia conoidea* (Brocchi, 1814) – Ceulemans *et al*., p. 127, pl. 7, figs 14-17 (*cum syn*.).

2018 *Megastomia conoidea* (Brocchi, 1814) – Brunetti & Cresti, p. 110, fig. 480.

2018 *Megastomia conoidea* (Brocchi, 1814) – Trigo *et al*., p. 361, fig. 20.

2020 *Megastomia conoidea* (Brocchi, 1814) – Landau *et al*., p. 288, pl. 9, figs 1-3.

?*non* 1950 *Odontostomia conoidea* (Brocchi) – Csepreghy-Meznerics, p. 36, pl. 2, fig. 10.

non 1958 *Odostomia conoidea* (Brocchi) – Sorgenfrei, p. 312, pl. 70, fig. 231 [= *Megastomia tuexeni* (Weinbrecht, 2002)].

non 1964 *Odostomia* (*Megastomia*) *conoidea* (Brocchi 1814) – Anderson, p. 323, pl. 46, fig. 282 [= *Megastomia tuexeni* (Weinbrecht, 2002)].

non 1984a *Odostomia* (*Megastomia*)? *conoidea* (Brocchi, 1814) – A.W. Janssen, p. 350, pl. 15, fig. 7 [= *Megastomia tuexeni* (Weinbrecht, 2002)].

non 1984 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Kuster-Wendenburg, p. 347, pl. 1, fig. 8 [= *Megastomia tuexeni* (Weinbrecht, 2002)].

non 1989 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Moths, p. 112, pl. 20, fig. 104 [= *Megastomia tuexeni* (Weinbrecht, 2002)].

?*non* 2002 *Odostomia* (*Megastomia*) *conoidea* (Brocchi, 1814) – Weinbrecht, p. 23, pl. 1, figs 1-12.

?*non* 2007 *Odostomia* (*Megastomia*) cf. *conoidea* (Brocchi, 1814) – Wienrich, p. 745, pl. 124, fig. 2, pl. 127, figs 5-6, pl. 161, fig. 5.

Material and dimensions – Maximum height 5.7 mm, width 2.4 mm. **CO**: NHMW 2019/0167/0253 (50+). **VC**: NHMW 2019/0167/0065 (1), NHMW 2019/0167/0066 (50+), NHMW 2019/0167/0750 (1). **VS**: NHMW 2019/0167/0813 (19). **EL**: NHMW 2019/0167/0414 (50+).

Discussion – *Megastomia conoidea* (Brocchi, 1814) is characterised by its helicoid protoconch of type A2, with the nucleus fully exposed to mostly obscured (Estepona specimens; dp = 240 μm), in having a relatively broad shell, in having orthocline growth lines and a strongly developed acute columellar fold. The shell is extremely variable (Peñas & Rolán, 1999a), and the last whorl may be rounded (in littoral forms) or have a more or less pronounced carina (in deeper-water forms) (Van Aartsen, 1987), the protoconch may be exposed completely above the first whorl, or partially immersed in first teleoconch whorl, as in figured specimen (Pl. 27, fig 1c). For further discussion see Landau *et al*. (2013, p. 309). *Megastomia aplicangulata* (Sacco, 1892) differs in having a type B protoconch (see above).

Distribution – Middle Miocene: Paratethys (Langhian-Serravallian): Bulgaria (Kojumdgieva & Strachimirov, 1960), Poland (Friedberg, 1928); Proto-Mediterranean Sea (Serravallian): Antalya Basin (İslamoğlu & Taner, 2003), Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: northeastern Atlantic (Tortonian): NW France (Landau *et al*., 2020), Algarve Basin, Portugal (Dollfus *et al*., 1903), southern Spain (Cárdenas *et al*., 2019); Proto-Mediterranean Sea (Tortonian and Messinian): Po Basin, Italy (Sacco, 1892a, 1904; Venzo & Pelosio, 1963), Turkey (early Tortonian): Antalya Basin (İslamoğlu & Taner, 2003). Lower Pliocene: North Sea Basin, British Isles (Harmer, 1920), Belgium (Marquet, 1998); Atlantic, NW France (Ceulemans *et al*., 2018), Guadalquivir Basin, Spain (Ruiz Muñoz *et al*., 1997; Landau *et al*., 2011); western Mediterranean, northeastern Spain (Martinell, 1982); central Mediterranean, Italy (Sacco, 1892a; Caprotti, 1974; Pavia, 1976; Crovato & Micali, 1992b; Forli *et al*., 1999; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018), Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, British Isles (Harmer, 1920), Belgium (Marquet, 1993, 1998); Atlantic, Mondego Basin, Portugal (Silva, 1992, 2001; NHMW 2018/0331/0277); western Mediterranean, Estepona Basin, Spain (Peñas & Rolán, 1999a), Roussillon Basin, France (Chirli & Richard, 2008); central Mediterranean, Italy (Sacco, 1892a, 1904; Cavallo & Repetto, 1992; Ferrero *et al*., 2005; Ragaini &

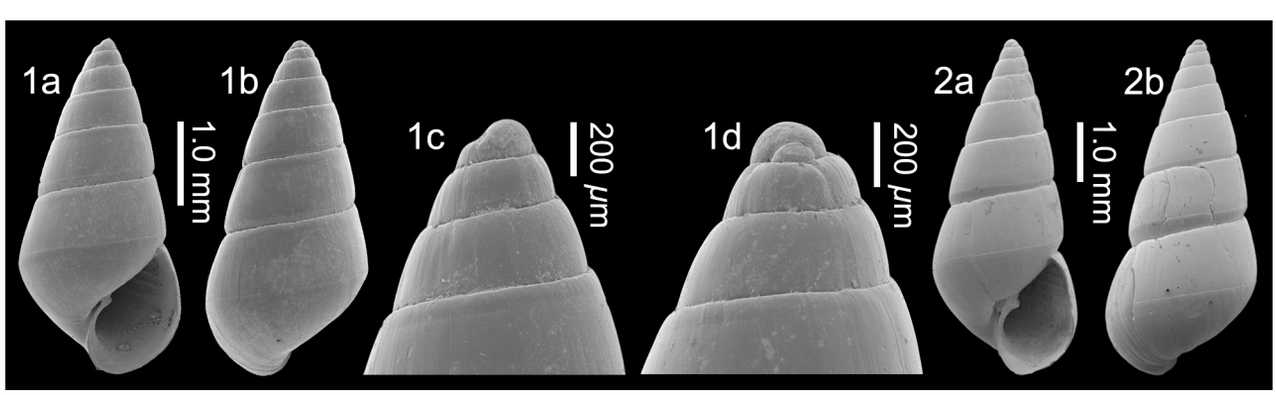

Plate 27. *Megastomia conoidea* (Brocchi, 1814); 1. NHMW 2019/0167/0065, height 4.5 mm, width 2.0 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0750, height 5.7 mm, width 2.4 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Bernieri, 2007; Sosso & Dell'Angelo, 2010; Bellagamba *et al*., 2013; Bellagamba & Micali, 2016); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Lower Pleistocene: North Sea Basin, British Isles (Harmer, 1920), Netherlands (Van Regteren Altena *et al*., 1964); western Mediterranean, Balearic Islands (Cuerda Barceló, 1987); central Mediterranean, Italy (Cerulli-Irelli, 1914; Pelosio, 1960; Greco, 1971; Di Geronimo *et al*., 1982; Gianolla *et al*., 2010; Brunetti, 2011); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic Norway, northwestern Spain (Trigo *et al*., 2018), to Canary Islands (Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), West Africa, Cape Verde Islands to Angola (Rolán, 2005), Sâo Tomé and Principe archipelagos (Nordsieck, 1972b; Van Aartsen *et al*., 2000; Rolán, 2005), absent in North Sea (Graham, 1988), Mediterranean (Bucquoy *et al*., 1882; Nordsieck, 1972b; Cachia *et al*., 2001; Solustri & Micali, 2004; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013).

***Megastomia conspicua* (Alder, 1850)**
Plate 28, figs 1-3

*1850	*Odostomia conspicua* Alder, p. 359.
1923	*Odostomia conspicua* Alder, 1850 – Harmer, p. 828, pl. 64, fig. 4.
1985a	*Odostomia conspicua* Alder, 1850 – Micali, p. 32, fig. 5.
1986	*Odostomia conspicua* Alder, 1850 – Fretter *et al*., p. 618, fig. 429.
1987	*Odostomia conspicua* Alder, 1850 – Van Aartsen, p. 7, 10, figs 10, 11.
1988	*Odostomia conspicua* Alder, 1850 – Graham, p. 606, fig. 264.
1996	*Odostomia conspicua* Alder, 1850 – Peñas *et al*., p. 44, fig. 105.
1999a	*Megastomia conspicua* (Alder, 1850) – Peñas & Rolán, p. 16, figs 22-27.
2001	*Odostomia conspicua* Alder, 1850 – Cachia *et al*., p. 101, pl. 16, fig. 2.
2011	*Odostomia conspicua* Alder, 1850 – Chirli & Micali, p. 57, pl. 18, figs 11-15.
2011	*Odostomia conspicua* Alder, 1850 – Chirli & Linse, p. 202, pl. 77, fig. 3.
2011	*Megastomia conspicua* (Brocchi, 1814) – Hernández *et al*., p. 257, figs 88Q-R.
2013	*Odostomia conspicua* Alder, 1850 – Öztürk *et al*., p. 144, fig. 7.
2014	*Odostomia conspicua* Alder, 1850 – Høisæter, p. 34, figs 49-50.
2014	*Megastomia conspicua* (Alder, 1850) – Giannuzzi-Savelli *et al*., p. 56, figs 123, 124, appendix p. 14, 61.
2018	*Megastomia conspicua* (Alder, 1850) – Trigo *et al*., p. 361, fig. 21.

Material and dimensions – Maximum height 2.3 mm, width 1.1 mm. **CO**: NHMW 2019/0167/0810 (1). **VC**: NHMW 2019/0167/0751 (1). **EL**: NHMW 2019/0167/0557-0558 (2), NHMW 2019/0167/0674 (6).

Discussion – *Megastomia conspicua* (Alder, 1850) is characterised by its solid, conical shell, large type A2 protoconch of about three whorls, with the nucleus completely exposed, teleoconch of up to six whorls, almost flat-sided spire whorls separated by a deeply impressed suture, prosocline growth lines, keeled last whorl in juvenile specimens, rounded in adults, imperforate base, and strong, sharp columellar fold. Although usually relatively large (2.5-9.0 mm height; Van Aartsen 1987), the Estepona specimens are small. Høisæter (2014, p. 34) also noted that the present-day Norwegian specimens were smaller than those reported by Van Aartsen (1987) from the Mediterranean.

Distribution – Lower Pliocene: North Sea Basin, British Isles (Harmer, 1920), central Mediterranean, Italy (Crovato & Micali, 1992b; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Tabanelli & Segurini, 1995); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Lower Pleistocene: North Sea Basin, British Isles (Harmer, 1920), northwestern Spain (Trigo *et al*., 2018), eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic Norway (Høisæter, 2014), British Isles (Fretter *et al*., 1986; Graham, 1988)

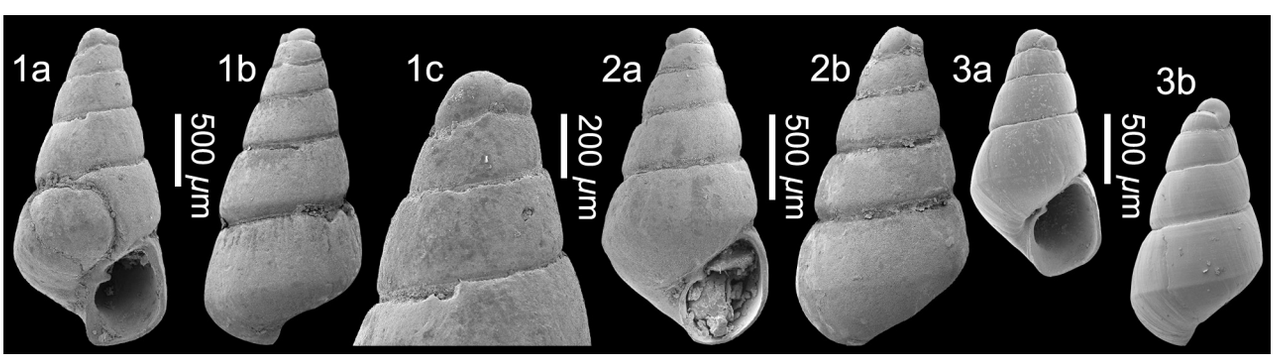

Plate 28. *Megastomia conspicua* (Alder, 1850); 1. NHMW 2019/0167/0557, height 2.3 mm, width 1.1 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0558, height 1.9 mm, width 995 μm. El Lobillo. 3. NHMW 2019/0167/0751, height 1.7 mm, width 920 μm (SEM images) Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

to Canary Islands (Van Aartsen *et al*., 1998; Hernández *et al*., 2011), Madeira (Van Aartsen *et al*., 1998), western Mediterranean (Peñas *et al.,* 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013).

***Megastomia rotundumbilicina* (Sacco, 1892)**
Plate 29, figs 1-2

*1892a	*Odontostomia rotumbilicina* Sacco, p. 36, pl. 1, fig. 76.
1892b	*Odontostomia rotundumbilicina* Sacco, p. 76 (name emendation).
?1966	*Odontostomia rotundumbilicina* (Sacco) – Kókay, p. 50, pl. 6, fig. 2.
1969	*Odontostomia rotumbilicina* [*sic*] Sacco – Fekih, p. 16, pl. 2, fig. 6.
1984	*Odontostomia rotundumbilicina* Sacco, 1892 – Ferrero Mortara *et al*., p. 72, pl. 10, fig. 3.

Material and dimensions – Maximum height 6.6 mm, width 2.6 mm. **CO**: NHMW 2019/0167/0259-0260 (2), NHMW 2019/0167/0260 (4). **VC**: NHMW 2019/0167/0135 (1). **EL**: NHMW 2019/0167/0425 (13), NHMW 2019/0167/0555-0556 (2).

Discussion – *Megastomia rotundumbilicina* (Sacco, 1892) is characterised by its relatively large, robust shell, with a tall conical spire, A2 type protoconch of about 2.25 whorls (dp = 200 μm), teleoconch of up to seven convex whorls, separated by a moderately deeply impressed suture, last whorl 47-49% of total height, with rounded periphery, deep prominent umbilical chink, the aperture is small, the outer lip strongly rounded, and the columella is short, strongly excavated, and bears a very strong fold mid-aperture. This species co-occurs with *M. conoidea* (Brocchi, 1814) in the Estepona assemblages (see above), from which it may be easily separated in having the protoconch more exposed, more convex whorls, the last whorl is not angular at the base, the umbilicus is wider, more strongly developed, the aperture smaller, and the columellar is shorter, with a stronger fold. The specimen from the middle Miocene Paratethys of Hungary illustrated by Kókay (1966, pl. 6, fig. 2) has its apex missing, without which we cannot be certain of the attribution. It is therefore excluded from the chresonymy.

Distribution – Lower Pliocene: central Mediterranean, Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984).

Genus *Noemiamea* de Folin, 1886

Type species – *Noemia valida* de Folin & Perrier, 1872 [= *Noemiamea dolioliformis* (Jeffreys, 1848)], by typification of replaced name, present-day, Gulf of Mexico.

1870	*Noemia* de Folin, p. 200. Junior homonym of *Noemia* Pasco, 1857 [Coleoptera].
1886	*Noemiamea* de Folin, *in* Hoyle, p. 94. *Nom. nov. pro Noemia* de Folin, 1870, non Pasco, 1857 [Coleoptera].
1901	*Oda* Monterosato, *in* Chaster, p. 8. *Nom. nov. pro Noemia* de Folin, 1870, non Pasco, 1857 [Coleoptera]. Junior objective synonym of *Noemiamea* de Folin, 1886.

***Noemiamea* sp.**
Plate 30, fig. 1

Material and dimensions – Height 1.6 mm, width 1.3 mm. **EL**: NHMW 2019/0167/0575 (1).

Discussion – The genus *Noemiamea* de Folin, 1886 comprises a small number of species with a low spire, globose last whorl, usually finely spirally striate, and a type A protoconch. One species, *Noemiamea dolioliformis* (Jeffreys, 1848), occurs in the eastern Atlantic from the British Isles to Morocco and into the Mediterranean (Peñas & Rolán, 1999a). That species is immediately separated

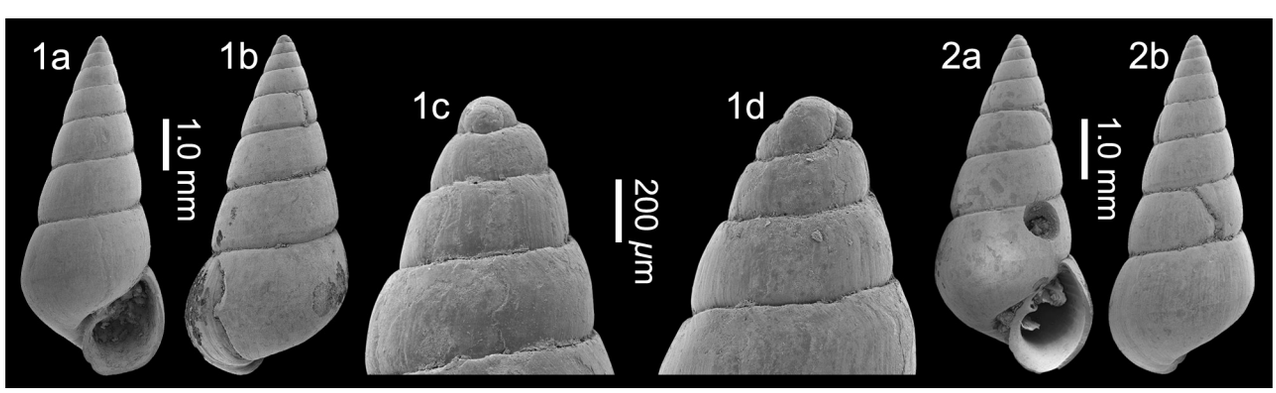

Plate 29. *Megastomia rotundumbilicina* (Sacco, 1892); 1. NHMW 2019/0167/0259, height 6.6 mm, width 2.6 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0260, height 5.7 mm, width 2.5 mm (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

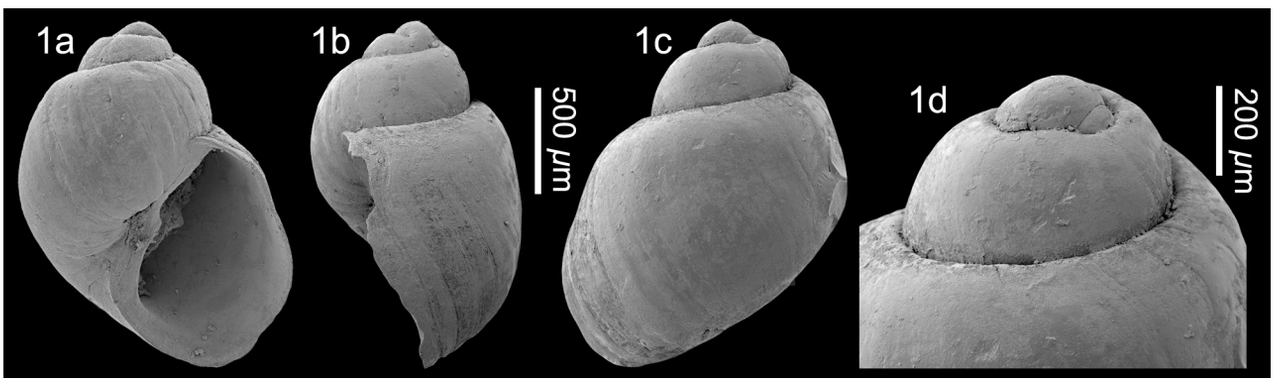

Plate 30. *Noemiamea* sp.; 1. NHMW 2019/0167/0575, height 1.6 mm, width 1.3 mm, 1d, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

from the Estepona specimen by its more exposed type A2 protoconch and the presence of regular fine spiral grooves over the entire teleoconch. We are unsure if this is an aberrant specimen or an undescribed species, and await further material.

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

Genus *Odostomia* Fleming, 1813

Type species – *Turbo plicatus* Montagu, 1803, by subsequent designation (Gray, 1847b), present-day, Europe.

1847b *Odostomia* Fleming, p. 76.
1839 *Odontostomia* Jeffreys, p. 34. Unjustified emendation of *Odostomia* Fleming, 1813.
1853 *Odontostoma* Philippi, p. 192. Unjustified emendation of *Odostomia* Fleming, 1813.
1886 *Ptychostomon* Locard, p. 228, 571. *Nom. nov. pro. Odostomia* Fleming, 1813, rejected by Locard as not properly formed.
1892a *Cyclodostomia* Sacco, p. 46. Type species (by subsequent designation, Verrill & Bush, 1900): *Odontostomia* (*Cyclodostomia*) *mutinensis* Sacco, 1892, Miocene, Italy.
1892a *Turritodostomia* Sacco, p. 53. Type species (by original designation): *Odostomia turrita* Hanley, 1844, present-day, British Isles.

Note – *Odostomia* Fleming, 1813 species are characterised by their small, elongate-conical shell, with a smooth surface, lacking any sculpture, and well developed columellar tooth (Schander, 1994). The protoconch can be of type A, B or C.

***Odostomia acuta* Jeffreys, 1848**
Plate 31, figs 1-2

*1848 *Odostomia acuta* Jeffreys, p. 338.
1850 *Odostomia umbilicata* Alder, p. 359.
1892a *Odontostomia acuta* var. *plioastensis* Sacco, p. 37, pl. 1, fig. 78.
1892a *Odontostomia acuta* var. *pedemontana* Sacco, p. 37, pl. 1, fig. 79.
1892a *Odontostomia acuta* var. *inflatorosea* Sacco, p. 37, pl. 1, fig. 80.
1892a *Odontostomia acuta* var. *obliquoides* Sacco, p. 38, pl. 1, fig. 81.
1914 *Odostomia acuta* Jeffr. – Cerulli-Irelli, p. 254 [428], pl. 22 [54], figs 34-37.
1925 *Odostomia acuta* Jeffreys – Harmer, p. 825, pl. 64, fig. 1.
1969 *Odontostomia acuta* Jeffreys – Fekih, p. 14, pl. 2, fig. 3.
1984 *Odontostomia acuta* var. *pedemontana* Sacco, 1892 – Ferrero Mortara *et al*., p. 72, pl. 10, fig. 10.
1988 *Odostomia acuta* Jeffreys, 1848 – Graham, p. 602, figs 262, 258, 252.1.
1996 *Odostomia acuta* Jeffreys, 1848 – Peñas *et al*., p. 39, figs 108-109, 111.
1998 *Odostomia acuta* Jeffreys, 1848 – Wilke & Van Aartsen, p. 11, pl. 8, fig. 23.
1999a *Odostomia acuta* Jeffreys, 1848 – Peñas & Rolán, p. 58, figs 131-135, 345.
2001 *Odostomia acuta* Jeffreys, 1848 – Cachia *et al*., p. 99, pl. 15, fig. 11.
2004 *Odostomia acuta* Jeffreys, 1848 – Repetto & Lacroce, p. 194, fig. 7.
2011 *Odostomia acuta* Jeffreys, 1848 – Chirli & Micali, p. 49, pl. 16, figs 6-11.
2013 *Odostomia acuta* Jeffreys, 1848 – Öztürk *et al*., p. 141, figs 2A-B.
2013 *Odostomia acuta* Jeffreys, 1848 – Bellagamba *et al*., p. 122, fig. 2N.
2014 *Odostomia acuta* Jeffreys, 1848 – Giannuzzi-Savelli *et al*., p. 42, fig. 44.
2014 *Odostomia acuta* Jeffreys, 1848 – Høisæter, p. 31, figs 38-42.
2018 *Odostomia acuta* Jeffreys, 1848 – Trigo *et al*., p. 361, fig. 17.
2020 *Odostomia acuta* Jeffreys, 1848 – Landau *et al*., p. 291, pl. 12, fig. 1.

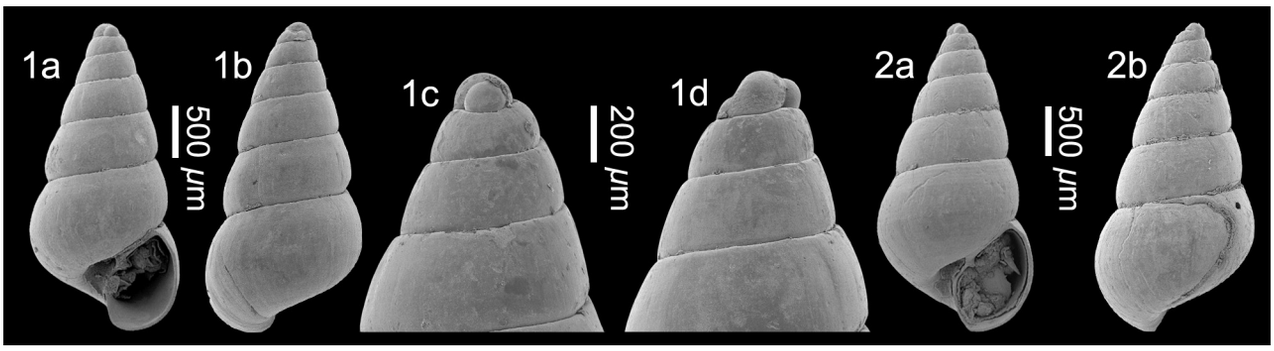

Plate 31. *Odostomia acuta* Jeffreys, 1848; 1. 2019/0167/0764, height 3.0 mm, width 1.4 mm, 1c-d, detail of protoconch; 2. 2019/0167/0765, height 3.2 mm, width 1.5 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 3.2 mm, width 1.5 mm. **VC**: NHMW 2019/0167/0805 (2). **EL**: NHMW 2019/0167/0764-766 (3), NHMW 2019/0167/0767 (45).

Discussion – *Odostomia acuta* Jeffreys, 1848 is characterised by its tall conical shell, type A2 protoconch, weakly convex whorls, orthocline or very slightly procoline axial growth lines, large, rounded last whorl, strongly developed and sharp columellar fold, and well-developed umbilicus. It is similar to the present-day northern European Atlantic *O. umbilicaris* (Malm, 1861), but differs in having a more solid, taller spired shell, less convex whorls, and having the growth lines almost orthocline, about 8-12° as opposed to 25-33° as in *O. umbilicaris* (Graham, 1988, fig. 252). We note that in the molecular work by Schander *et al*. (2003, fig. 2) *O. acuta* was excluded from the *Odostomia* clade and formed a sister group to *Megastomia*. It lacks the internal labial lirae typical of *Megastomia* and we provisionally keep it in *Odostomia* pending further molecular data.

Distribution – Upper Miocene: Atlantic (Tortonian and Messinian), NW France (Landau *et al*., 2020). Lower Pliocene: North Sea Basin, Coralline Crag, England (Harmer, 1925); western Mediterranean, Tunisia (Fekih, 1969); central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: North Sea Basin, Red Crag, England (Harmer, 1925); Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0280); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Repetto & Lacroce, 2004; Guioli *et al*., 2009; Bellagamba *et al*., 2013). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1925); central Mediterranean, Italy (Cerulli-Irelli, 1914). Upper Pleistocene: Ireland (Harmer, 1925). Present-day: Eastern Atlantic frontage from Norway to British Isles (Graham, 1988), northwestern Spain (Trigo *et al*., 2018), south to Canaries, Madeira and Selvagens Islands (Segers *et al*., 2009), Cape Verde Islands to Angola (Peñas & Rolán, 1999a) into Mediterranean (Peñas *et al*., 1996; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014; Høisæter, 2014), eastern Mediterranean (Öztürk *et al*., 2013), Black Sea (Wilke & Van Aartsen, 1998).

***Odostomia bernardi* Van Aartsen, Gittenberger & Goud, 1998**

Plate 32, fig. 1

*1998 *Odostomia bernardi* Van Aartsen, Gittenberger & Goud, p. 37, figs 41, 63.

Material and dimensions – Height 1.7 mm, width 860 µm. **EL**: NHMW 2019/0167/0757 (1).

Discussion – Although represented by a single specimen, we ascribe it to *Odostomia bernardi* Van Aartsen, Gittenberger & Goud, 1998. This species is characterised by its small ovate shell, type C tending to B protoconch, teleoconch composed of 2.5-3 convex whorls, separated by a deep, narrowly impressed suture, relatively large inflated last whorl (Estepona specimen 73% of total height), and orthocline to slightly prosocline growth lines. The aperture is relatively large (Estepona specimen 42% of total height), columella strongly oblique, bearing a fold deep within. Van Aartsen *et al*. (1998, p. 38) compared this species to the European *Odostomia glabrata* Forbes & Hanley, 1850, as figured by Van Aartsen (1987, p. 30, fig. 26) that differs in having a slenderer, less ovate shell, with clearly prosocline growth lines, and a larger protoconch. This is the first fossil record for this species that today is known only from the Azores

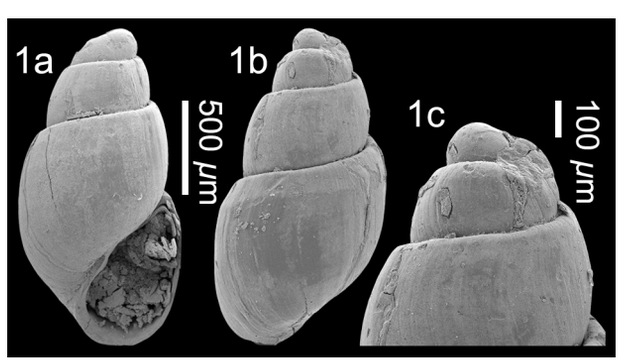

Plate 32. *Odostomia bernardi* Van Aartsen, Gittenberger & Goud, 1998; 1. NHMW 2019/0167/0757, height 1.7 mm, width 860 µm (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Azores (Van Aartsen *et al*., 1998).

***Odostomia conoastensis* (Sacco, 1892)**
Plate 33, fig. 1

*1892a	*Odontostomia* (*Turritodostomia*) *turrita* var. *conoastensis* Sacco, p. 42, pl. 1, fig. 90.
1976	*Odostomia* (*Brachystomia*) *conoastensis* (Sacco, 1892) – Pavia, p. 156, pl. 10, figs 3-5.
1992	*Odostomia* (*Megastomia*) *conoastensis* (Sacco, 1892) – Cavallo & Repetto, p. 160, fig. 453.
2011	*Odostomia conoastensis* (Sacco, 1892) – Chirli & Micali, p. 52, pl. 17, figs 10-15.

Material and dimensions – Maximum height 4.4 mm, width 2.0 mm. **CO**: NHMW 2019/0167/0753 (1).

Discussion – This species is characterised by its relatively tall conical spire, small type C protoconch (description of protoconch being type B in Chirli & Micali, p. 52 is a *lapsus*) , teleoconch composed of up to seven convex whorls, separated by a weakly impressed suture, devoid of sculpture, except weak orthocline growth lines. The last whorl is globose, subobsoletely angled at the periphery, bearing a small umbilical chink, and the columellar fold is moderately well developed. Sacco (1892a) originally described it as a variety of *Odostomia turrita* Hanley, 1844, but that species is easily separated by its type A2 protoconch, fine spiral sculpture, and prosocline growth lines. Some authors have placed the species in the genus *Megastomia* Monterosato, 1884 (Cavallo & Repetto, 1992, p. 160), however, there are no lirae within the aperture.
This species differs from *Odostomia algoensis* Thiele, 1925 from South Africa, Angola & Congo (Peñas & Rolán, 1999a) in having a more depressed protoconch, more superficial suture, less convex whorls, narrower umbilicus, and lack of lirations within the outer lip, which places *O. algoensis* it in the genus *Megastomia* Monterosato, 1884.

Distribution – Upper Miocene: Atlantic, southern Spain (Cárdenas *et al*., 2019). Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Benigni & Corcelli, 1982; Guioli *et al*., 2009; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Aimassi & Ferrero Mortara, 1984; Cavallo & Repetto, 1992; Baroncelli, 2001).

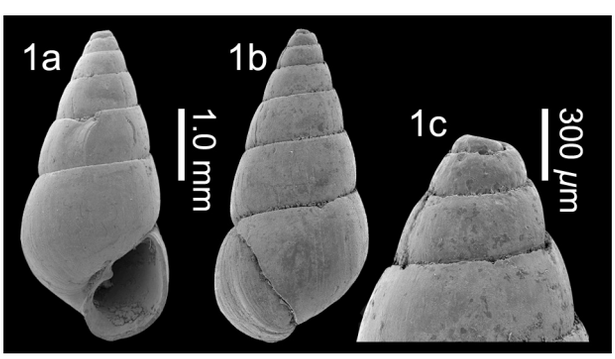

Plate 33. *Odostomia conoastensis* (Sacco, 1892); 1. NHMW 2019/0167/0753, height 4.4 mm, width 2.0 mm, 1c, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Odostomia digitulus* Peñas & Rolán, 1999**
Plate 34, fig. 1

*1999a	*Odostomia digitulus* Peñas & Rolán, p. 110, figs 293-296.
2014	*Odostomia digitulus* Peñas & Rolán, 1999 – Peñas *et al*., p. 139, fig. 11E.

Material and dimensions – Maximum height 2.0 mm, width 870 μm. **CO**: NHMW 2019/0167/0449 (1), NHMW 2019/0167/0450 (1). **EL**: NHMW 2019/0167/0775 (1), NHMW 2019/0167/0776 (11).

Discussion – *Odostomia digitulus* Peñas & Rolán, 1999 is characterised by its small subcylindrical shell, type C protoconch, teleoconch of four convex whorls, with the periphery just above the suture, separated by a moderately impressed linear suture, surface smooth, except for orthocline growth lines, and the columella bears a weak fold. The protoconch diameter is 270 μm, similar to that described by Penãs & Rolán for the extant West African specimens (280 μm; 1999a, p. 110). For comparison with related species, see Peñas & Rolán (1999a, p. 110). This is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Senegal to Angola (Peñas & Rolán, 1999a; Peñas *et al*., 2014).

***Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998**
Plate 35, fig. 1

*1998	*Odostomia* (*Odostomia*) *dijkhuizeni* Van Aartsen, Gittenberger & Goud, p. 25, fig. 27.
1999a	*Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998 – Peñas & Rolán, p. 78, figs 208-215, 346.
2014	*Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998 – Peñas *et al*., p. 139, fig. 11F.

Material and dimensions – Height 2.7 mm, width 1.3 mm. **EL**: NHMW 2019/0167/0611 (1).

Discussion – Although represented by a single imperfectly preserved specimen, we ascribe it to *Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998. This species is characterised by its small size, conical to ovate-conical profile, type C tending to B protoconch,

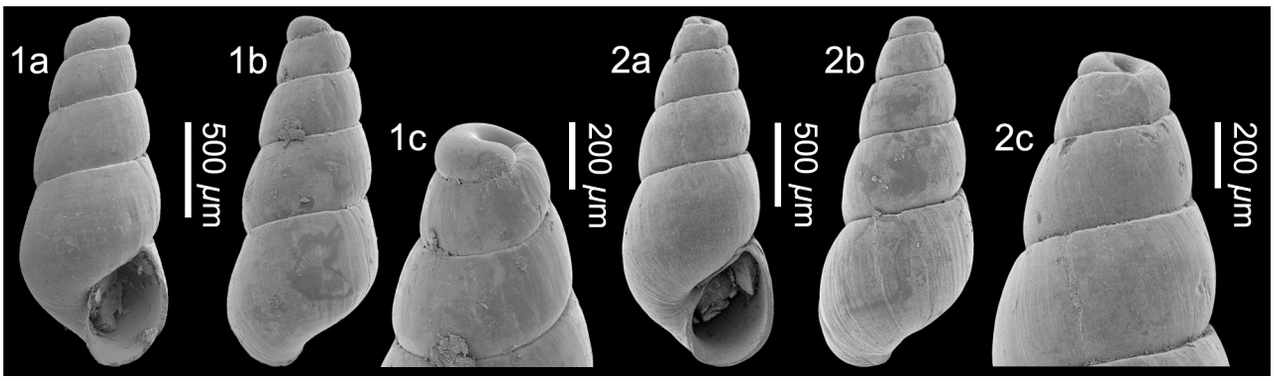

Plate 34. *Odostomia digitulus* Peñas & Rolán, 1999; 1. NHMW 2019/0167/0449, height 1.9 mm, width 725 µm, 1c, detail of protoconch (SEM image). Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0775, height 2.0 mm, width 870 µm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

teleoconch composed of four convex, slightly gradate whorls, separated by a deep, narrowly impressed suture, relatively large last whorl (Estepona specimen 65% of total height), flexuous growth lines, with a single weak subsutural grooves present in some specimens. The aperture is relatively large (Estepona specimen 41% of total height), columella strongly oblique, bearing a prominent fold just above mid-columella. Peñas & Rolán (1999a, p. 80) noted the variability in profile, the Estepona specimen tends towards the broader range for the species. The peristome could be continuous or not (Estepona specimen discontinuous), as seen in the specimens from the northern end of its present-day distribution. For comparison with similar species see Peñas & Rolán (1999a, p. 80).

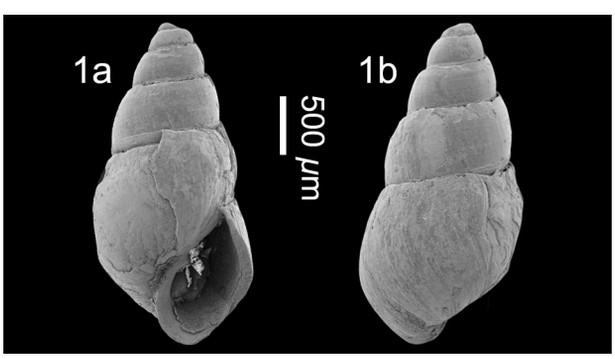

Plate 35. *Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998; 1. NHMW 2019/0167/0611, height 2.7 mm, width 1.3 mm (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Mauritania (Van Aartsen *et al*., 1998), Senegal, Ghana (Peñas & Rolán, 1999a) to Angola (Peñas *et al*., 2014).

***Odostomia gomezi* Peñas, Rolán & Swinnen, 2014**
Plate 36, figs 1-2

*2014 *Odostomia gomezi* Peñas, Rolán & Swinnen, p. 164, figs 20D-E.

Material and dimensions – Maximum height 2.0 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0758-0759 (2), NHMW 2019/0167/0760 (11).

Discussion – *Odostomia gomezi* Peñas, Rolán & Swinnen, 2014 is characterised by its relatively thin, low-

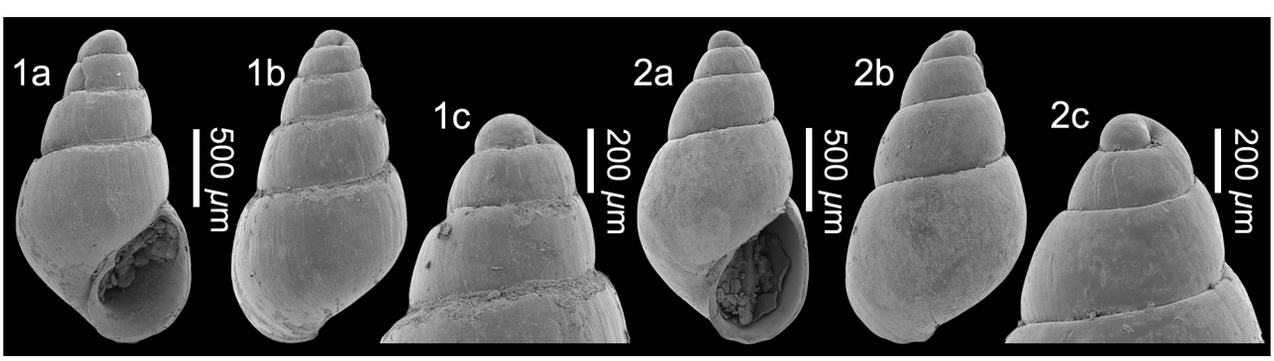

Plate 36. *Odostomia gomezi* Peñas, Rolán & Swinnen, 2014; 1. NHMW 2019/0167/0758, height 2.0 mm, width 1.1 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0759, height 1.9 mm, width 1.0 mm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

spired, conical shell, rather elevated type C tending to B protoconch, teleoconch of three convex whorls separated by deeply impressed suture, last whorl ovate, surface smooth, except for orthocline to slightly prosocline growth lines, pyriform aperture, oblique, curved columella with a weak fold. For comparison with related species, see Penãs *et al*. (2014, p. 164). This is the first fossil record for this species that today is known only from the Canary Islands.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Canary Islands (Peñas *et al*., 2014).

***Odostomia jacquesi* Peñas & Rolán, 1999**
Plate 37, figs 1-2

*1999a	*Odostomia jacquesi* Peñas & Rolán, p. 105, figs 276-283.
2014	*Odostomia jacquesi* Peñas & Rolán, 1999 – Peñas *et al*., p. 142, fig. 12F.

Material and dimensions – Maximum height 1.9 mm, width 980 μm. **EL**: NHMW 2019/0167/0761-0762 (2).

Discussion – *Odostomia jacquesi* Peñas & Rolán, 1999 is characterised by its small, rather solid, conico-truncated shell, type C protoconch, teleoconch of four flat-sided, slightly gradate whorls, with the periphery at the abapical suture, separated by a weakly oblique, deeply impressed linear suture, surface smooth, except for orthocline growth lines, and the columella is oblique and bears a weak fold. For extensive comparison with related species, see Peñas & Rolán (1999a, p. 105-106).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Senegal to Angola (Peñas & Rolán, 1999a; Peñas *et al*., 2014).

***Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984**
Plate 38, fig. 1

*1984	*Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, p. 52, fig. 249.
1987	*Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984 – Van Aartsen, p. 9, 12, fig. 20.
1996	*Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984 – Peñas *et al*., p. 46, figs 120, 121.
2013	*Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984 – Öztürk *et al*., p. 146, fig. 11.
2014	*Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984 – Giannuzzi-Savelli *et al*., p. 44, fig. 55, appendix p. 8, 55.

Material and dimensions – Height 1.6 mm, width 820 μm. **EL**: NHMW 2019/0167/0625 (1).

Discussion – *Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984 is characterised by its minute size, conical profile, elevated type B protoconch, teleoconch of up to four weakly convex whorls separated by a narrowly impressed suture, orthocline growth lines, the last whorl rounded at the base, aperture pyriform, and columellar fold moderately prominent. Nofroni & Tringali (1995, p.

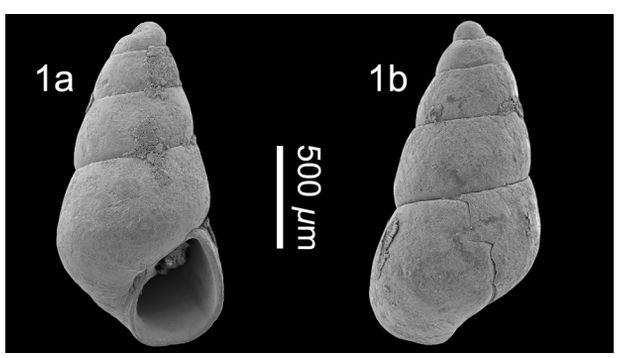

Plate 38. *Odostomia kromi* Van Aartsen, Menkhorst & Gittenberger, 1984; 1. NHMW 2019/0167/0625, height 1.6 mm, width 820 μm (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

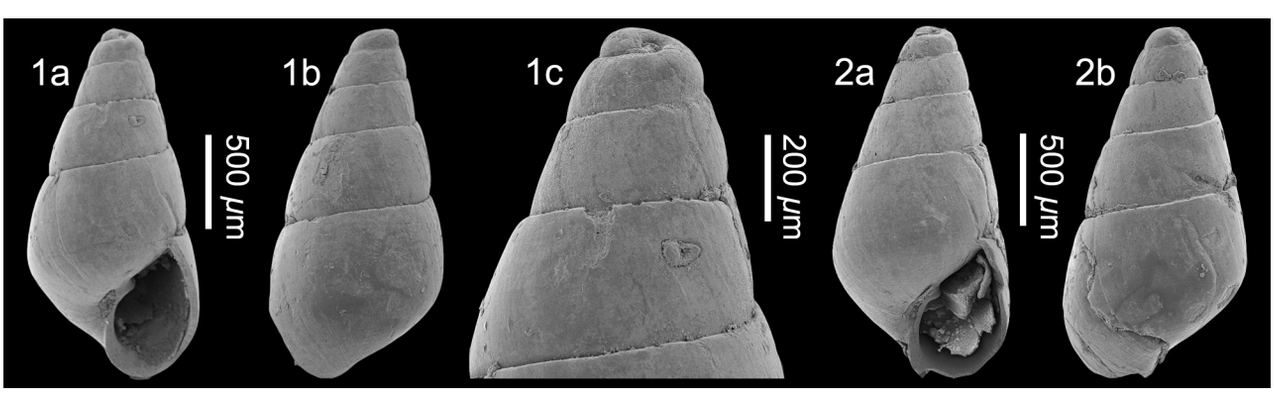

Plate 37. *Odostomia jacquesi* Peñas & Rolán, 1999; 1. NHMW 2019/0167/0761, height 1.9 mm, width 925 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0762, height 1.9 mm, width 980 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

37) considered this a junior subjective synonym of *Odostomia imponderabilior* Oberling, 1970. However, Giannuzzi-Savelli *et al*. (2014, p. 8, 55) argued that Oberling's unfigured description was too imprecise to confirm such synonymy. It is similar to *O. plicata* (Montagu, 1803), with which it co-occurs in the Estepona assemblage, but has a type B protoconch instead of type A2. As far as we are aware, this is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996; Giannuzzi-Savelli *et al*., 2014); central Mediterranean (Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

***Odostomia lukisii* Jeffreys, 1859**
Plate 39, figs 1-2

*1859	*Odostomia Lukisii*	Jeffreys, p. 112, pl. 3, fig. 19.
1980a	*Odostomia lukisi* [*sic*]	Jeffreys, 1859 – Warén, p. 38, pl. 6, figs 25, 26.
1984	*Odostomia lukisii*	Jeffreys, 1859 – Van Aartsen *et al*., p. 53, fig. 253.
1986	*Brachystomia lukisi* [*sic*]	(Jeffreys, 1859) – Fretter *et al*., p. 605, figs 417-419.
1987	*Odostomia lukisii*	Jeffreys, 1859 – Van Aartsen, p. 8, 12, fig. 9.
1988	*Brachystomia lukisi* [*sic*]	(Jeffreys, 1858 [*sic*]) – Graham, p. 590, figs 257, 253, 252/10.
1996	*Odostomia lukisii*	Jeffreys, 1859 – Peñas *et al*., p. 46, figs 138, 139.
1999a	*Odostomia lukisii*	Jeffreys, 1859 – Peñas & Rolán, p. 74, figs 188-190.
2001	*Odostomia lukisii*	Jeffreys, 1859 – Cachia *et al*., p. 103, pl. 16, fig. 7.
2011	*Odostomia lukisii*	Jeffreys, 1859 – Hernández *et al*., p. 260, figs 89H-I.
2013	*Odostomia lukisii*	Jeffreys, 1859 – Öztürk *et al*., p. 147, fig. 13.
2014	*Odostomia lukisii*	Jeffreys, 1859 – Giannuzzi-Savelli *et al*., p. 44, fig. 57, appendix p. 8, 55.
2014	'*Brachystomia*' *lukisi* [*sic*]	(Jeffreys, 1859) – Høisæter, p. 34, figs 34-37.
2016	*Odostomia lukisii*	Jeffreys, 1859 – Bellagamba & Micali, p. 139, figs 3B, C.
2018	*Odostomia lukisii*	Jeffreys, 1859 – Trigo *et al*., p. 361, fig. 24.

Material and dimensions – Maximum height 2.3 mm, width 1.0 mm. **VS**: NHMW 2019/0167/0812 (1). **EL**: NHMW 2019/0167/0638-0639 (2), NHMW 2019/0167/0770 (10).

Discussion – *Odostomia lukisii* Jeffreys, 1859 is characterised by its small size, conical profile with truncated apex, strongly flattened type C protoconch, teleoconch of up to four strongly convex whorls separated by a deeply impressed suture, orthocline growth lines, the last whorl rounded at the base with a small umbilical chink, aperture pyriform, and columellar fold prominent. Although sometimes placed in the genus *Brachystomia* Monterosato, 1884, Høisæter (2014, p. 30) noted that its soft parts separated it from other genera. It is here placed in *Odostomia* pending further study.
Høisæter (2014, p. 30) argued in favour of the spelling '*lukisi*', however, Jeffreys' (1867) change of mind where he spelt it with one '*i*' is not important. In the original description he established *Odostomia lukisii*, implicitly latinizing Lukis into Lukisius, hence *lukisii*. This was a correctly formed name and there is no reason to change it (P. Bouchet pers. comm. BL, 25/01/2021).

Distribution – Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0275); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Bellagamba & Micali, 2016). Present-day: Eastern Atlantic, Norway (Høisæter , 2014), British Isles (Jeffreys, 1859; Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), Azores, Madeira and Selvagens Islands (Van Aartsen *et al*., 1998; Segers *et al*., 2009), south to West Africa, Mauritania, Canary Islands (Van Aartsen *et al*., 1998; Hernández *et al*., 2011), to Angola (Peñas & Rolán, 1999a), into western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996); central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013).

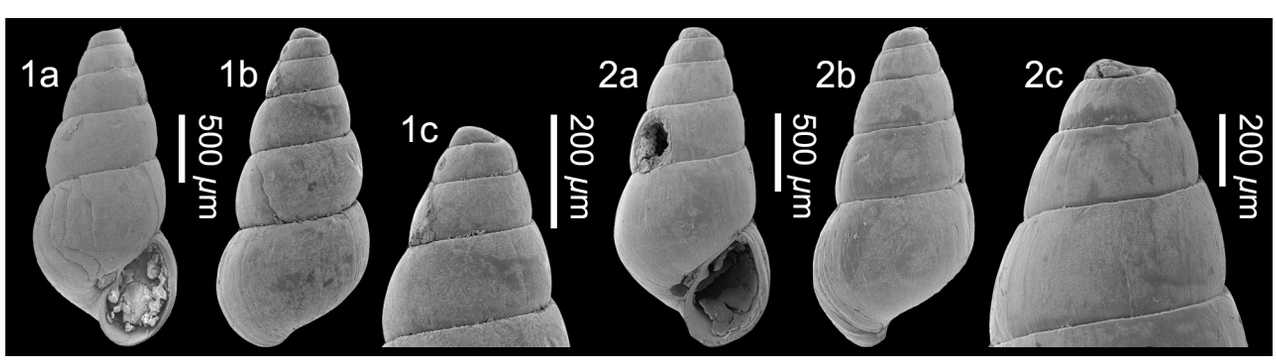

Plate 39. *Odostomia lukisii* Jeffreys, 1859; 1. NHMW 2019/0167/0638, height 2.3 mm, width 1.0 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0639, height 2.0 mm, width 1.0 mm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

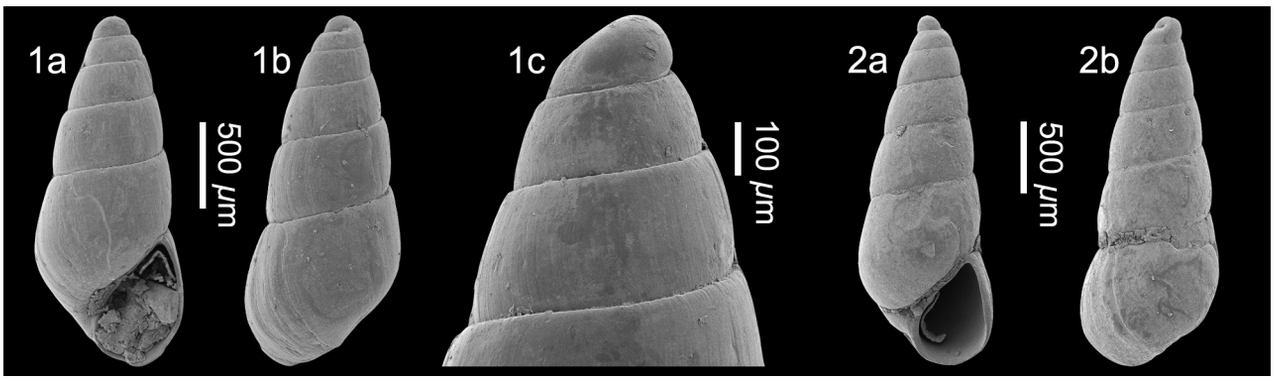

Plate 40. *Odostomia malagensis* nov. sp.; 1. **Holotype** NHMW 2019/0167/0758, height 2.1 mm, width 860 μm, 1c, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0759, height 2.4 mm, width 900 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

***Odostomia malagensis* nov. sp.**
Plate 40, figs 1-2

Type material – Holotype NHMW 2019/0167/0758, height 2.1 mm, width 860 μm; paratype 1 NHMW 2019/0167/0759, height 2.4 mm, width 900 μm.

Other material – Known from type series only.

Type locality – El Lobillo, Estepona, Spain.

Type stratum – lower Piacenzian, upper Pliocene.

Etymology – Named after the province of Malaga, South Spain, in which Estepona is located. *Odostomia* gender feminine.

Diagnosis – *Odostomia* species of small size, relatively tall, slender, subconical slightly cyrtoconoid spire, type B protoconch, teleoconch of up to five weakly convex whorls, weakly prosocline growth lines, strongly oblique columella, weak fold.

Description – Shell small, relatively tall spired and slender, subconical slightly cyrtoconoid spire. Protoconch type B. Teleoconch of up to five weakly convex whorls separated by moderately impressed linear suture. Growth lines weakly prosocline. Last whorl weakly inflated, rounded at base. Aperture pyriform, columella strongly oblique with weak fold placed mid-height.

Discussion – *Odostomia malagensis* nov. sp. differs from other relatively tall slender congeners: *Odostomia pyxidata* Scander, 1994 from West Africa has a more involute type C protoconch and a deeper V-shaped suture; *O. extenuata* Peñas & Rolán, 1999 also has a type C protoconch, the spire whorls are slightly gradate, and sinuous opisthocline growth lines; *O. digitulus* Peñas & Rolán, 1999 from West Africa that also occurs in the Estepona assemblages, differs again in having a tuncated rather than pointed apex due to its type C protoconch, slightly deeper suture and a weakly excavated, less oblique columella; *O. paardekooperi* Van Aartsen, Gittenberger & Goud, 1998 from the Cape Verde Islands also has a type B protoconch, but has a more regularly conical spire, more inflated last whorl and strongly prosocline growth lines.

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

***Odostomia nardoi* Brusina, 1869**
Plate 41, figs 1-2

*1869	*Odostomia nardoi* Brusina, p. 241.
1972b	*Odostomia nardoi* Brusina, 1869 – Nordsieck, p. 110, pl. PIII, fig. 31.
1987	*Odostomia nardoi* Brusina, 1869 – Van Aartsen, p. 10, 13, fig. 28.
1996	*Odostomia nardoi* Brusina, 1869 – Peñas *et al*., p. 48, fig. 140.
2014	*Odostomia nardoi* Brusina, 1869 – Giannuzzi-Savelli *et al*., p. 44, fig. 59, appendix p. 8, 55.

Material and dimensions – Maximum height 1.4 mm, width 930 μm. **EL**: NHMW 2019/0167/0656-0657 (2), NHMW 2019/0167/0658 (1).

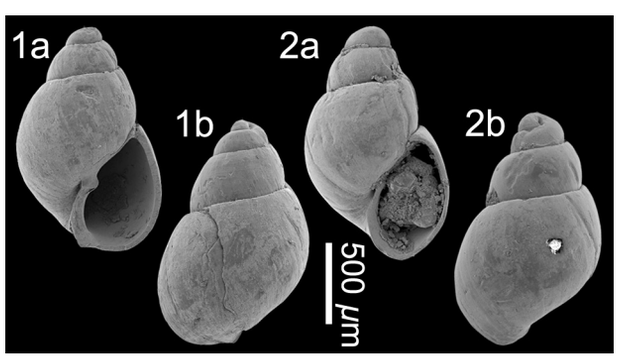

Plate 41. *Odostomia nardoi* Brusina, 1869; 1. NHMW 2019/0167/0656, height 1.4 mm, width 930 μm; 2. NHMW 2019/0167/0657, height 1.4 mm, width 910 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Odostomia nardoi* Brusina, 1869 is characterised by its very small size and globular shape, type B protoconch, low-spired teleoconch composed of three strongly convex whorls separated by a deep, narrowly impressed suture, prosocline growth lines, inflated last whorl, large ovate-pyriform aperture, weak columellar fold, and narrow umbilical chink. The specimen figured by Giannuzzi-Savelli *et al*. (p. 44, fig. 59) has a more depressed protoconch, of type B tending to C, whereas the specimen figured by Peñas *et al*. (p. 48, fig. 140) has a type B protoconch very similar to that seen in the Estepona specimens. As far as we are aware, this is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: western Mediterranean (Nordsieck, 1972b; Peñas *et al*., 1996), eastern Mediterranean (Brusina, 1869; Giannuzzi-Savelli *et al*., 2014), south into Atlantic to Selvagens Islands (Nordsieck & García-Talavera, 1979).

***Odostomia plicata* (Montagu, 1803)**
Plate 42, fig. 1

*1803	*Turbo plicatus* Montagu, p. 325.
1835	*Melania bulimus* Scacchi, p. 11, pl. 2, fig. 3.
1865	*Odostomia vitrea* Brusina, p. 21.
1872	*Odostomia plicata* Mont. – Wood, p. 63, pl. 4, fig. 22.
1882	*Odostomia turrita* Montagu – Bucquoy *et al*., p. 163, pl. 19, figs 3-5.
1893	*Odostomia plicata* var. *carinata* Marshall, p. 253.
1914	*Odontostomia plicata* Mtg. – Cerulli-Irelli, p. 255 [429], pl. 22 [54], fig. 44.
1923	*Odostomia plicata* (Montagu) – Harmer, p. 837, pl. 64, fig. 18.
1969	*Odontostomia plicata* (Montagu) – Fekih, p. 14, pl. 2, fig. 6.
1972b	*Odostomia plicata* (Montagu, 1803) – Nordsieck, p. 113, pl. PIV, fig. 7.
1984	*Odostomia plicata* (Montagu, 1803) – Van Aartsen *et al*., p. 52, fig. 250.
1985c	*Odostomia plicata* (Montagu, 1803) – Micali, p. 48, fig. 2.
1986	*Odostomia plicata* (Montagu, 1803) – Fretter *et al*., p. 609, fig. 420.
1987	*Odostomia plicata* (Montagu, 1803) – Van Aartsen, p. 8, 11, fig. 16.
1988	*Odostomia plicata* (Montagu, 1803) – Graham, p. 596, fig. 259.
1996	*Odostomia plicata* (Montagu, 1803) – Peñas *et al*., p. 50, figs 112-113.
1999a	*Odostomia plicata* (Montagu, 1803) – Peñas & Rolán, p. 56, figs 124, 125.
2001	*Odostomia plicata* (Montagu, 1803) – Cachia *et al*., p. 103, pl. 16, fig. 9.
2013	*Odostomia plicata* (Montagu, 1803) – Öztürk *et al*., p. 148, fig. 15.
2014	*Odostomia plicata* (Montagu, 1803) – Giannuzzi-Savelli *et al*., p. 46, figs 61, 62, appendix p. 8, 54.
2014	*Odostomia plicata* (Montagu, 1803) – Høisæter, p. 35, fig. 51.
2018	*Odostomia plicata* (Montagu, 1803) – Trigo *et al*., p. 362, fig. 26.

Material and dimensions – Maximum height 2.1 mm, width 790 μm. **EL**: NHMW 2019/0167/0646 (1), NHMW 2019/0167/0647 (1).

Discussion – *Odostomia plicata* (Montagu, 1803) is characterised by its small size, tall conical spire, type A2 protoconch, teleoconch of up to five weakly convex to flat-sided whorls, smooth except for orthocline growth lines, last whorl weakly angled at the base, imperforate or small umbilical chink, and the presence of a strong, sharp columellar fold. This species differs from *O. turrita* Hanley, 1844 in its taller profile, lack of spiral sculpture, and orthocline instead of prosocline growth lines. It has been recorded in various works on Pliocene assemblages, but none are accompanied by a good figure.

Distribution – Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1872; Harmer, 1923); western Mediterranean; Estepona Basin, S. Spain (this paper), Tunisia (Fekih, 1969). Upper Pliocene: Estepona Basin, S. Spain (this paper). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1923); central Mediterranean, Italy (Cerulli-Irelli, 1914). Present-day: Eastern Atlantic, southern Scandinavia, British Isles (Nordsieck, 1972b;

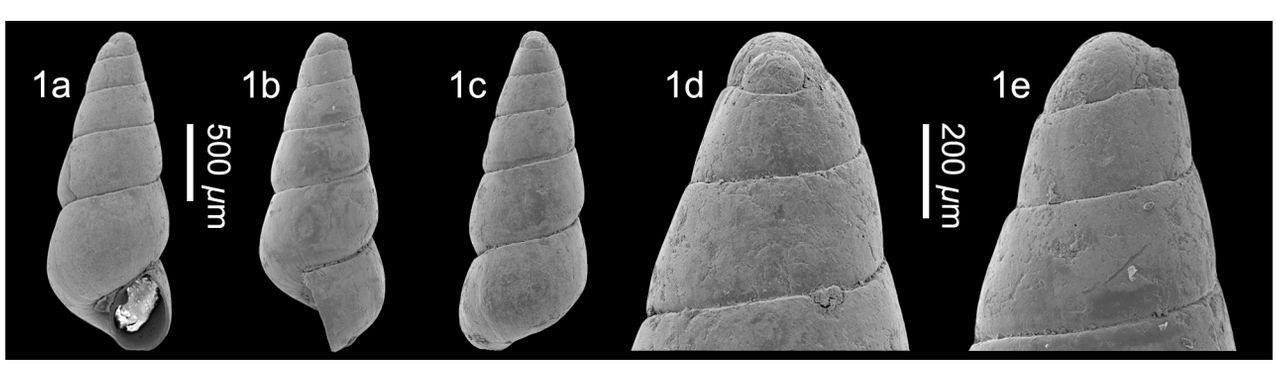

Plate 42. *Odostomia plicata* (Montagu, 1803); 1. NHMW 2019/0167/0646, height 2.1 mm, width 790 μm, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Fretter *et al*., 1986; Graham, 1988; Høisæter, 2014), northwestern Spain (Trigo *et al*., 2018), to West Africa, Mauritania (Peñas & Rolán, 1999a), into western Mediterranean (Bucquoy *et al*., 1882; Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Micali, 1985c; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013), Black Sea (Nordsieck, 1972b).

Odostomia romburghi Van Aartsen, Gittenberger & Goud, 1998

Plate 43, figs 1-3

*1998	*Odostomia* (*Odostomia*) *romburghi* Van Aartsen, Gittenberger & Goud, p. 22, fig. 23.
1999a	*Odostomia romburghi* Aartsen, Gittenberger y Goud, 1998 – Peñas & Rolán, p. 62, figs 151, 152.
2005	*Odostomia romburghi* Aartsen, Gittenberger y Goud, 1998 – Rolán, p. 184, fig. 859.

Material and dimensions – Maximum height 4.1 mm, width 1.9 mm. **CO**: NHMW 2019/0167/0248-0249 (2), NHMW 2019/0167/0455 (1). **EL**: NHMW 2019/0167/0552-0553 (2), NHMW 2019/0167/0554 (12).

Discussion – *Odostomia romburghi* Van Aartsen, Gittenberger & Goud, 1998 is characterised by its slender, straight-sided, evenly conical spire, A2 type protoconch, prosocline growth lines, very faint spiral striations, sharply carinate last whorl, outer lip sharply angled at carina, narrow umbilical chink present in some specimens, and prominent columellar tooth placed just above mid-columella. The Estepona specimens are poorly preserved and the protoconch and spiral microsculpture are abraded, but the shell shape and strong columellar fold are typical for the species. It is most like *O. unidentata* (Montagu, 1803), but differs in the much slenderer shape of the shell, shallower suture, and the quite different dimensions. At the stage of six whorls, an average *O. unidentata* measures 5.0 mm in height, whereas *O. romburghi* reaches only 3.0 mm. For the protoconchs the sizes are more than 350 μm versus c. 200 μm (Van Aartsen *et al*., 1998, p. 22). Peñas & Rolán (1999a, p. 63) were less convinced by the differences given by the original authors, and suggested it might just be a local variant of *O. unidentata*. We prefer to separate the two. As far as we are aware, this is the first fossil record for this species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Cape Verde Islands (Van Aartsen *et al*., 1998; Rolán, 2005).

Odostomia striolata Forbes & Hanley, 1850

Plate 44, figs 1-3

*1850	*Odostomia striolata* Forbes & Hanley, p. 267.
1883	*Odostomia Monterosatoi* Bucquoy, Dautzenberg & Dollfus, p. 167, pl. 19, fig. 15.
1923	*Odostomia striolata* (Alder) Forbes & Hanley – Harmer, p. 831, pl. 64, fig. 8.
1984	*Odostomia striolata* Forbes & Hanley, 1850 – Van Aartsen, p. 51, fig. 247.
1987	*Odostomia striolata* Forbes & Hanley, 1850 – Van Aartsen, p. 9, 13, fig. 25.
1994	*Odostomia striolata* Forbes y Hanley, 1850 – Schander, fig 6f.
1996	*Odostomia striolata* Forbes y Hanley, 1850 – Peñas *et al*., p. 52, figs 127, 128.
1999a	*Odostomia striolata* Forbes y Hanley, 1850 – Peñas & Rolán, p. 88, figs 234-240.
2001	*Odostomia striolata* Forbes & Hanley, 1850 – Cachia *et al*., p. 104, pl. 16, fig. 11.
2011	*Odostomia striolata* Forbes & Hanley, 1850 – Hernández *et al*., p. 262, fig. 89P.
2014	*Odostomia striolata* Forbes y Hanley, 1850 – Peñas *et al*., p. 148, figs 15A-D.
2014	*Odostomia striolata* Forbes & Hanley, 1850-51 – Høisæter, p. 38, figs 58-62.
2014	*Odostomia striolata* Forbes & Hanley, 1850 – Giannuzzi-Savelli *et al*., p. 48, figs 73-75, appendix p. 9, 56.
2018	*Odostomia striolata* Forbes & Hanley, 1850 – Trigo *et al*., p. 362, fig. 28.

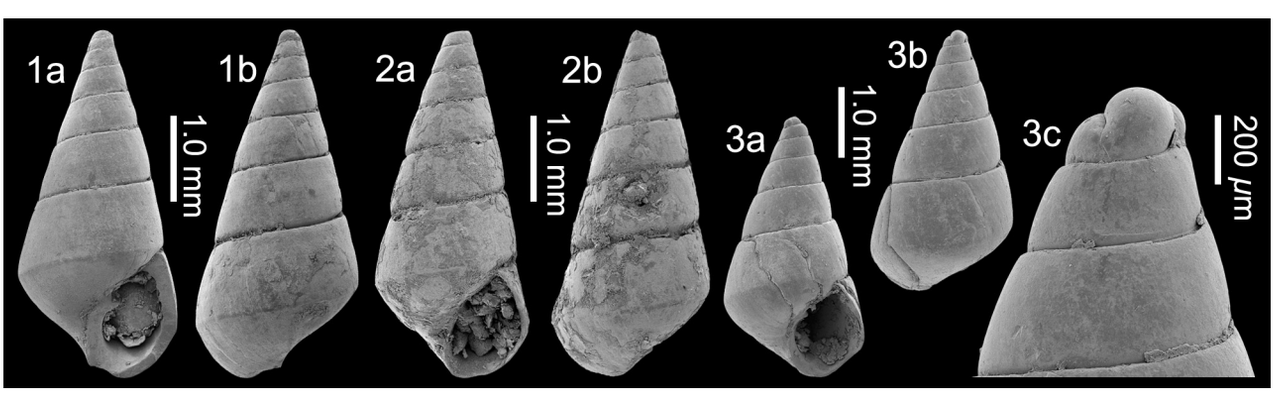

Plate 43. *Odostomia romburghi* Van Aartsen, Gittenberger & Goud, 1998; 1. NHMW 2019/0167/0248, height 4.0 mm, width 1.9 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0249, height 4.1 mm, width 1.9 mm; 3. NHMW 2019/0167/0455, height 3.5 mm, width 1.8 mm, 3c, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

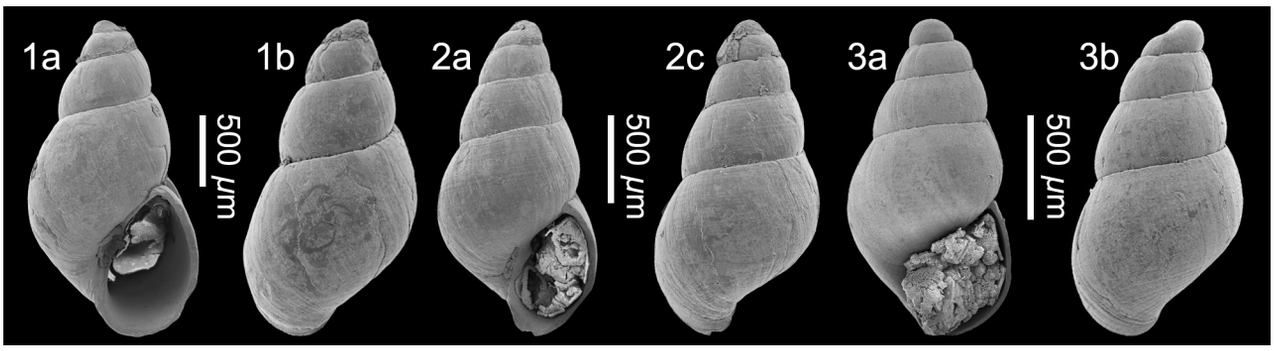

Plate 44. *Odostomia striolata* Forbes & Hanley, 1850; 1. NHMW 2019/0167/0627, height 2.2 mm, width 1.2 mm; 2. NHMW 2019/0167/0628, height 1.8 mm, width 910 μm; 3. NHMW 2019/0167/0629, height 1.5 mm, width 770 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 2.2 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0804 (1). **EL**: NHMW 2019/0167/0627-0629 (3), NHMW 2019/0167/0630 (4).

Discussion – *Odostomia striolata* Forbes & Hanley, 1850 is characterised by its small shell, conical spire, type B protoconch, teleoconch of three weakly convex whorls, weakly angular last whorl at the base, imperforate, prosocline growth lines, and spiral sculpture consisting of a weak subsutural grooves and very fine microscopic spirals.
The species is highly variable in both protoconch size and teleoconch profile (Peñas & Rolán, 1999a, p. 90). The Estepona specimens are on average smaller than those found today in the Mediterranean (maximum height 2.2 mm vs up to 3.2 mm; Giannuzzi-Savelli *et al*., 2014, figs 73, 74) and the spiral sculpture is less prominent. Specimens from Gran Canaria figured by Hernández *et al*. (2011) and Peñas *et al*. (2014, figs 15A-D) are even smaller than those from Estepona with a larger diameter protoconch and, like the Estepona specimens, the subsutural cordlet is almost obsolete. They probably are extreme forms of this very variable species.

Distribution – Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0276); western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1923). Present-day: Atlantic, Norway (Høisæter, 2014), northwestern Spain (Trigo *et al*., 2018), Canary Islands (Van Aartsen *et al*., 1998; Hernández *et al*., 2011), Madeira and Selvagens Islands (Van Aartsen *et al*., 1998; Segers *et al*., 2009; Peñas *et al*., 2014), Azores (Van Aartsen *et al*., 1998), West Africa, Cape Verde Islands to Ghana (Peñas & Rolán, 1999a), into western Mediterranean (Bucquoy *et al*., 1883; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001), eastern Mediterranean (Micali & Palazzi, 1992).

Odostomia turrita Hanley, 1844
Plate 45, figs 1-2

*1844 *Odostomia turrita* Hanley, p. 18.
1853 *Odostomia unidentata* var. *turrita* Hanley – Forbes & Hanley, p. 267, pl. 95, fig. 9.
1882 *Odostomia turrita* Hanley – Bucquoy *et al*., p. 162, pl. 19, figs 1, 2.
1892a *Odontostomia* (*Turritodostomia*) *turrita* var. *inflatoastensis* Sacco, p. 42, pl. 1, fig. 91.
1892a *Odontostomia* (*Turritodostomia*) *turrita* var. *planastensis* Sacco, p. 42, pl. 1, fig. 92.
1914 *Odontostomia turrita* Hanley – Cerulli-Irelli, p. 255 [429], pl. 22 [54], figs 40-43.
1923 *Odostomia turrita* Hanley – Harmer, p. 827, pl. 64, fig. 3.
1972b *Odostomia turrita* Hanley, 1844 – Nordsieck, p. 113, pl. PIV, fig. 8.
1984 *Odostomia turrita* Hanley, 1844 – Van Aartsen *et al*., p. 51, fig. 248.
1985c *Odostomia turrita* Hanley, 1844 – Micali, p. 47, fig. 1.
1986 *Odostomia turrita* Hanley, 1844 – Fretter *et al*., p. 614, figs 425, 426.
1987 *Odostomia turrita* Hanley, 1844 – Van Aartsen, p. 8, 12, fig. 18.
1988 *Odostomia turrita* Hanley, 1844 – Graham, p. 598, fig. 260.
1996 *Odostomia turrita* Hanley, 1844 – Peñas *et al*., p. 54, figs 116-117.
1999a *Odostomia turrita* Hanley, 1844 – Peñas & Rolán, p. 56, figs 126-130.
2001 *Odostomia turrita* Hanley, 1844 – Cachia *et al*., p. 104, pl. 17, fig. 1.
2011 *Odostomia turrita* Hanley, 1844 – Chirli & Micali, p. 64, pl. 22, figs 1-3.
2011 *Odostomia turrita* Hanley, 1844 – Hernández *et al*., p. 262, figs 89R-S.
2013 *Odostomia turrita* Hanley, 1844 – Öztürk *et al*., p. 150, fig. 20.
2014 *Odostomia turrita* Hanley, 1844 – Giannuzzi-Savelli *et al*., p. 48, fig. 80, appendix p. 9, 57.
2014 *Odostomia turrita* Hanley, 1844 – Høisæter, p. 38, figs 58-62.
2018 *Odostomia turrita* Hanley, 1844 – Trigo *et al*., p. 362, fig. 29.
2020 *Odostomia turrita* Hanley, 1844 – Raven, p. 43, fig. 57.

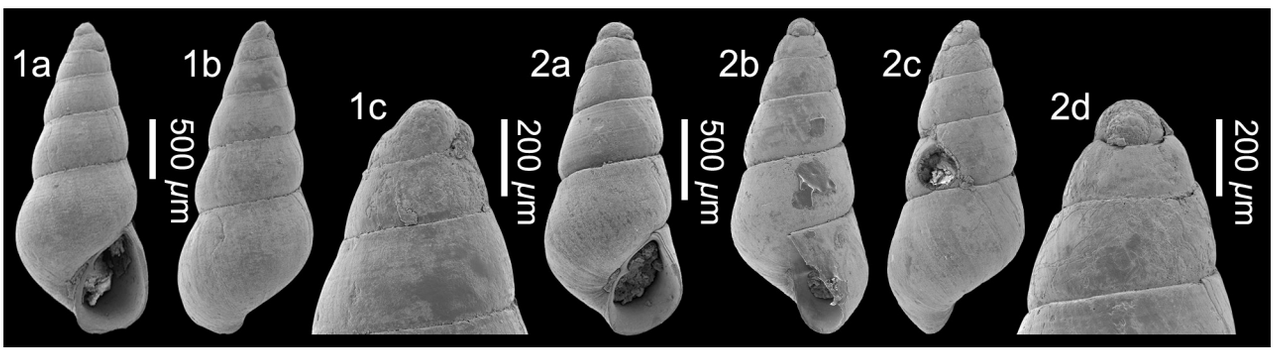

Plate 45. *Odostomia turrita* Hanley, 1844; 1. NHMW 2019/0167/0643, height 2.6 mm, width 1.1 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0644, height 1.9 mm, width 845 µm, 2d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

non 1892a *Odontostomia* (*Turritodostomia*) *turrita* var. *conoastensis* Sacco, p. 42, pl. 1, fig. 90 [*Odostomia conoastensis* (Sacco, 1892)].

Material and dimensions – Maximum height 2.6 mm, width 1.1 mm. **CO**: NHMW 2019/0167/0749 (1). **EL**: NHMW 2019/0167/0643-0644 (2), NHMW 2019/0167/0645 (28).

Discussion – *Odostomia turrita* Hanley, 1844 is characterised by its small-sized, solid shell, elongated, conical spire of up to five flat to weakly convex whorls, type A2 protoconch of two whorls, teleoconch with prosocline growth lines and extremely fine, irregular spiral striae. The periphery of the last whorl is usually, but not always, weakly angular and the outer lip oblique, with the columellar fold well developed. Although Chirli & Micali (2011, p. 64) recorded it as fossil for the first time in the Mediterranean, its presence in the North Sea Basin (Harmer, 1923) and now western Mediterranean suggests the species was widespread along the European Atlantic Frontage and Mediterranean in the Pliocene.

Distribution – Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Crovato & Micali, 1992b; Chirli & Micali, 2011). Upper Pliocene: North Sea Basin, Red Crag, England (Harmer, 1923); western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Sacco, 1892a). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1925); central Mediterranean, Italy (Cerulli-Irelli, 1914). Upper Pleistocene: Ireland (Harmer, 1923). Present-day: Eastern Atlantic, Norway to British Isles (Forbes & Hanley, 1853; Nordsieck, 1972b; Fretter *et al*., 1986; Graham, 1988; Høisæter, 2014), North Sea (Raven, 2020), northwestern Spain (Trigo *et al*., 2018), Canaries (Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), West Africa, Mauritania, Cape Verde Islands (Nordsieck, 1972b, Van Aartsen *et al*., 1998), Morocco to Angola (Peñas & Rolán, 1999a), into western Mediterranean (Bucquoy *et al*., 1882; Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Micali, 1985c; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2013).

Odostomia unidentata **(Montagu, 1803)**

Plate 46, figs 1-3

*1803	*Turbo unidentatus* Montagu, p. 324.
1846	*Turbonilla albella* Lovén, p. 19.
1857	*Odostomia unidentata* Montague [*sic*] – Wood, p. 317, pl. 31, fig. 11.
1867	*Odostomia unidentata* var. *elata* Jeffreys, p. 134 (non A. Adams, 1860).
1882	*Odostomia unidentata* Montagu – Bucquoy *et al*., p. 161, pl. 19, figs 13-14.
1892a	*Odontostomia unidentata* (Mont.) – Sacco, p. 38.
1892a	*Odontostomia unidentata* var. *perpyramidata* Sacco, p. 38, pl. 1, fig. 82.
1892a	*Odontostomia unidentata* var. *savonensis* Sacco, p. 38, pl. 1, fig. 83.
1892a	*Odontostomia unidentata* var. *pseudoturrita* Sacco, p. 38, pl. 1, fig. 84.
1892a	*Odontostomia unidentata* var. *pseudopallida* Sacco, p. 39, pl. 1, fig. 85.
1914	*Odontostomia unidentata* Mtg. – Cerulli-Irelli, p. 255 [429], pl. 22 [54], figs 38-39.
1923	*Odostomia unidentata* (Montagu) – Harmer, p. 830, pl. 64, figs 6, 7.
1933	*Odostomia litoris* Coen, p. 192.
1964	*Odostomia* (*Odostomia*) *unidentata* (Montagu, 1803) – Van Regteren Altena *et al*., p. 4, fig. 195.
1969	*Odontostomia unidentata* (Montagu) – Fekih, p. 16, pl. 2, fig. 7.
1972b	*Odostomia* (*Megastomia*) *unidentata* (Montagu, 1803) – Nordsieck, p. 109, pl. PIII, fig. 22.
1985a	*Odostomia unidentata* (Montagu, 1803) – Micali, p. 35, fig. 2.
1986	*Odostomia unidentata* (Montagu, 1803) – Fretter *et al*., p. 614, figs 425, 426, 431 bottom left.
1987	*Odostomia unidentata* (Montagu, 1803) – Van Aartsen, p. 8, 11, fig. 17.
1988	*Odostomia unidentata* (Montagu, 1803) – Graham, p. 604, fig. 263, 258, 252.7.
?1992	*Odostomia* (*Odostomia*) *unidentata* (Montagu, 1803) – Cavallo & Repetto, p. 158, fig. 445.
1993	*Odostomia* (*O.*) *unidentata* (Montagu, 1803) – Marquet, p. 94, pl. 4, figs 11, 12.

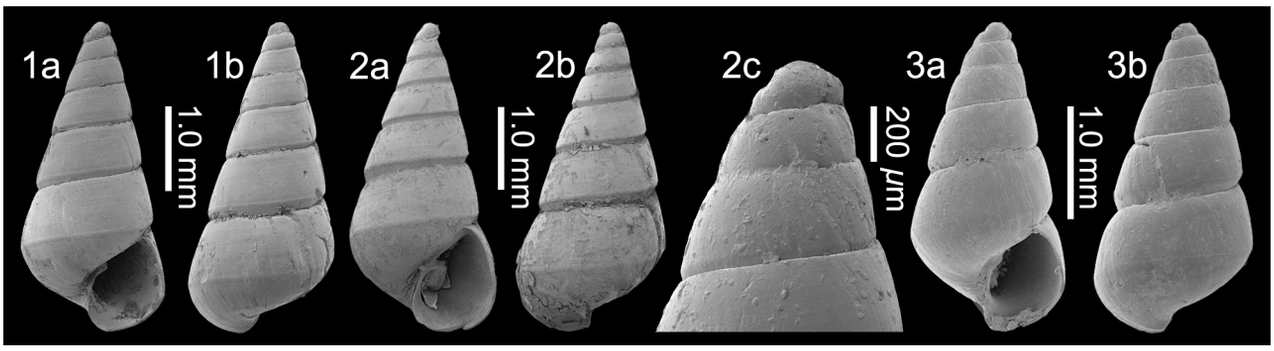

Plate 46. *Odostomia unidentata* (Montagu, 1803); 1. NHMW 2019/0167/0547, height 3.8 mm, width 1.6 mm; 2. NHMW 2019/0167/0548, height 3.6 mm, width 1.6 mm, 2c, detail of protoconch. El Lobillo. 3. NHMW 2019/0167/0301, height 2.7 mm, width 1.3 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

1996 *Odostomia unidentata* (Montagu, 1803) – Peñas *et al*., p. 54, figs 125, 126.
1996 *Odostomia unidentata* (Montagu, 1803) – Peñas *et al*., p. 54, figs 114-115.
1998 *Odostomia* (*O.*) *unidentata* (Montagu, 1803) – Ferrero *et al*., p. 49, 52, pl. 2, fig. 3.
1998 *Odostomia* (*O.*) *unidentata* (Montagu, 1803) – Marquet, p. 198, fig. 170.
1998 *Odostomia* (*Odostomia*) *unidentata* (Montagu, 1803) – Van Aartsen *et al*., p. 23, fig. 24.
1999a *Odostomia unidentata* (Montagu, 1803) – Peñas & Rolán, p. 63, figs 153-161.
2001 *Odostomia unidentata* (Montagu, 1803) – Cachia *et al*., p. 105, pl. 17, fig. 2.
2011 *Odostomia unidentata* (Montagu, 1803) – Chirli & Micali, p. 65, pl. 22, figs 4-11.
2011 *Odostomia unidentata* (Montagu, 1803) – Chirli & Linse, p. 203, pl. 78, fig. 3.
2011 *Odostomia unidentata* (Montagu, 1803) – Hernández *et al*., p. 263, fig. 89T-U.
2013 *Odostomia unidentata* (Montagu, 1803) – Öztürk *et al*., p. 150, fig. 21A-B.
2013 *Odostomia unidentata* (Montagu, 1803) – Landau *et al*., p. 310, pl. 75, fig. 2.
2014 *Odostomia unidentata* (Montagu, 1803) – Giannuzzi-Savelli *et al*., p. 48, figs 76, 77, appendix p. 9, 57.
2014 *Odostomia unidentata* (Montagu, 1803) – Høisæter, p. 38, figs 63-67.
2014 *Odostomia unidentata* (Montagu, 1803) – Peñas *et al*., p. 150, figs 16A-B.
2018 *Odostomia unidentata* (Montagu, 1803) – Trigo *et al*., p. 362, fig. 30.
2020 *Odostomia unidentata* (Montagu, 1803) – Landau *et al*., p. 296, pl. 20, fig. 1.
2020 *Odostomia unidentata* (Montagu, 1803) – Raven, p. 43, fig. 58.

non 1987 *Odostomia unidentata* (Montagu, 1803) – Van Aartsen, p. 11, fig. 17 (*O. turgida* Sars, 1878).
non 1988 *Brachystomia albella* (Lovén, 1846) – Fretter *et al*., p. 604, fig. 416, 419 photo on right [*Brachystomia carrozzai* (Van Aartsen, 1987)].
non 1988 *Brachystomia albella* (Lovén, 1846) – Graham, p. 588, figs 256, 253, 252.8 [*Brachystomia carrozzai* (Van Aartsen, 1987)].
non 1997 *Brachystomia albella* (Lovén, 1846) – Marquet, p. 107, pl. 9, fig. 11 [*Brachystomia carrozzai* (Van Aartsen, 1987)].

Material and dimensions – Maximum height 3.8 mm, width 1.6 mm. **VC**: NHMW 2019/0167/0301 (1), NHMW 2019/0167/0302 (3). **EL**: NHMW 2019/0167/0412 (34), NHMW 2019/0167/0547-0548 (2).

Discussion – *Odostomia unidentata* (Montagu, 1803) is characterised by its tall conical spire, type A2 helicoid protoconch, almost flat sided teleoconch whorls, the last whorl angular at the periphery, prosocline growth lines and well developed columellar fold. Peñas & Rolán (1999a) noted the considerable variability seen in this species in the extant faunas, and Chirli & Micali (2011) in the Italian Pliocene assemblages. The Estepona specimens fit well within the species concept. This species may be separated from *O. acuta* Jeffreys, 1848 by its less convex whorls, the lack of umbilicus and the subangulate periphery. It differs from *Megastomia alungata* (Nordsieck, 1972) in completely lacking an umbilicus, the less protruding columellar fold, and more squared aperture. For the comparison with *O. romburghi* Van Aartsen, Gittenberger & Goud, 1998, see under that species (*hoc opus*).

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian and Messinian), NW France (Landau *et al*., 2020). Lower Pliocene: North Sea Basin, Coralline Crag, England (Harmer, 1923); western Mediterranean, Tunisia (Fekih, 1969); central Mediterranean, Italy (Sacco, 1892a; Crovato & Micali, 1992b; Guioli *et al*., 2009; Chirli & Micali, 2011). Upper Pliocene: North Sea Basin, Red Crag, England (Wood, 1853; Harmer, 1923), Kruisschans and Oorderen Sands, Belgium (Marquet, 1993, 1998); Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0287); western Mediterranean, Estepona Basin, S. Spain (Peñas & Rolán, 1999a); central Mediterranean, Italy (Sacco, 1892a;

?Cavallo & Repetto, 1992; Ferrero *et al*., 1998). Upper Pliocene-Pleistocene: North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964). Lower Pleistocene: Atlantic, St Erth, England (Harmer, 1923); central Mediterranean, Italy (Cerulli-Irelli, 1914; Gianolla *et al*., 2010; Brunetti, 2011); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: Ireland (Harmer, 1923). Present-day: Eastern Atlantic frontage from North Iceland, Norway to British Isles (Nordsieck, 1972b; Høisæter, 2014), North Sea (Raven, 2020), northwestern Spain (Trigo *et al*., 2018), Azores, Madeira and Selvagens Islands (Segers *et al*., 2009), south to Canaries (Hernández *et al*., 2011), West Africa, Cape Verde Islands to Angola (Peñas *et al*., 2009, 2014), into western Mediterranean (Bucquoy *et al*., 1882; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

Genus *Ondina* de Folin, 1870

Type species – *Ondina semiornata* de Folin *in* de Folin & Périer, 1872 [= *Ondina warreni* (Thompson, 1845)], by subsequent monotypy (Van Aartsen, 1984), present-day, France (Atlantic).

1847b *Auriculina* Gray, p. 159. Type species (by original designation): *Odostomia obliqua* Alder, 1844, present-day, British Isles. Junior homonym of *Auriculina* Grateloup, 1838 [Ringiculidae].
1870 *Ondina* de Folin *in* de Folin & Périer, p. 200.

Note – The relationship between the genera *Ondina* de Folin *in* de Folin & Périer, 1870 and *Odetta* de Folin *in* de Folin & Périer, 1870 was discussed by Van Aartsen (1984), and the European species were reviewed in a subsequent paper (Van Aartsen, 1987). A more recent review of extant northern European species was given by (Høisæter, 2014).
Ondina species are relatively thin shelled, elongated and cyrtoconoid in profile, with a broad type B or C protoconch, opisthocline sinuous growth lines, the sinus placed close to the adapical suture, they often bear spiral sculpture on the abapical part of the whorls, although some species are smooth, the aperture is pyriform, and the columellar fold is weakly developed.

***Ondina cerullii* (Cossmann, 1921)**
Plate 47, fig. 1

1914 *Odontostomia lineolata* Cerulli-Irelli, p. 256 [430], pl. 22 [54], fig. 45 (*non* Sandberger, 1859).
*1921 *Odontostomia Cerullii* Cossmann, p. 238 (*nom. nov. pro Odontostomia lineolata* Cerulli-Irelli, 1914, *non* Sandberger, 1859).
1976 *Evalea cerullii* (Cossmann, 1921) – Pavia, p. 154, pl. 10, figs 7, 8.
1992 *Odostomia* (*Jordaniella*) *cerullii* (Cossmann, 1921) – Cavallo & Repetto, p. 158, fig. 448.

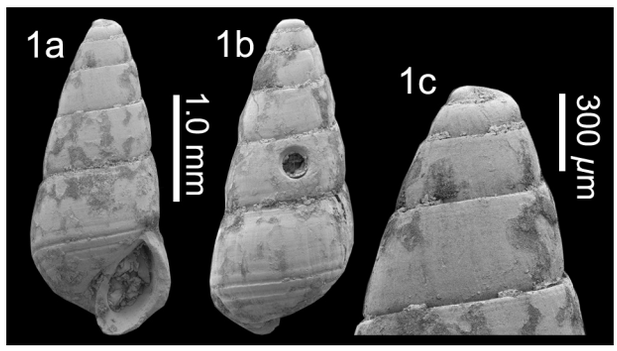

Plate 47. *Ondina cerullii* (Cossmann, 1921); 1. NHMW 2019/0167/0101, height 3.0 mm, width 1.3 mm, 1c, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

2011 *Ondina cerullii* (Cossmann, 1921) – Chirli & Micali, p. 69, pl. 24, figs 1-3.
2011 *Ondina cerullii* (Cossmann, 1921) – Chirli & Linse, p. 203, pl. 79, fig. 1.

non 1997 *Brachystomia cerullii* Marquet, p. 107, pl. 10, fig. 1 (*nom nov. pro Odontostomia lineolata* Cerulli-Irelli, 1914, *non* Sandberger, 1859; junior homonym of *O. cerullii* Cossmann, 1921) (? = *Odostomia derivata* Wood, 1879).
non 1998 *Brachystomia* cf. *cerullii* (Cossmann, 1921) – Marquet, p. 197, fig. 169 (? = *Odostomia derivata* Wood, 1879).

Material and dimensions – Height 3.0 mm, width 1.3 mm. **CO**: NHMW 2019/0167/0101 (1).

Discussion – Cossmann (1921, p. 238) noted that the species described by Cerulli-Irelli (1914, p. 430, pl. 54, fig. 45) from the lower Pleistocene of Italy was preoccupied by *Odontostoma lineolatum* Sandberger, 1859 and proposed new name *Odontostomia Cerullii*. Marquet (1997, p. 107) also noted the homonymy, and proposed the same trivial name for the species employed by Cossmann, 1921.
Ondina cerullii (Cossmann, 1921) is characterised by its small size, type C protoconch, teleoconch with a conical spire composed of 4-5 weakly convex whorls separated by a deeply impressed suture. The last whorl is not particularly inflated, convex, rounded at the base, with a moderately large umbilicus. The teleoconch surface is covered by extremely fine spiral grooves. On the penultimate whorl a deeper spiral groove develops just above the suture and continues on the last whorl delimiting the base, which bears a further 4-5 deep grooves. The aperture is pyriform, the columella thickened and erect abapically bearing a single well developed fold mid-aperture. It is also thicker shelled than most of the extant European *Ondina* species. In sculpture it is most like *O. warreni* (Thompson, 1845), but that species is thinner shelled with more convex whorls, and has a more inflated last whorl. For further discussion see under *O. warreni*. We do not believe the Pliocene North Sea Basin species illustrated

by Marquet (1997, pl. 10, fig. 1; 1998, fig. 1) represent this species. The Belgian shell is very similar if not conspecific with the fossil *Odostomia derivata* Wood, 1879 from Bramerton Crag of England.

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Cavallo & Repetto, 1992). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914); eastern Mediterranean, Rhodes (Chirli & Linse, 2011).

***Ondina diaphana* (Jeffreys, 1848)**
Plate 48, fig. 1

*1848	*Odostomia diaphana* Jeffreys, p. 341.
1884	*Odostomia* (*Auriculina*) *dilucida* Monterosato, p. 97.
1893	*Odostomia diaphana* var. *inflata* Marshall, p. 253.
1987	*Ondina diaphana* (Jeffreys, 1848) – Van Aartsen, p. 14, 18, figs 53, 54.
1995	*Ondina diaphana* (Jeffreys, 1848) – Micali, p. 18, figs 6-8.
1995	*Ondina diaphana* (Jeffreys, 1848) – Schander, p. 60, fig. 1E.
1996	*Ondina dilucida* (Monterosato, 1884) – Peñas *et al*., p. 56, fig. 149.
1998	*Ondina dilucida* (Monterosato, 1884) – Van Aartsen *et al*., p. 19, fig. 19.
1999a	*Ondina diaphana* (Jeffreys, 1848) – Peñas & Rolán, p. 128, fig. 316.
2001	*Ondina diaphana* (Jeffreys, 1848) – Cachia *et al*., p. 107, pl. 17, fig. 8.
2011	*Ondina diaphana* (Jeffreys, 1848) – Chirli & Micali, p. 69, pl. 24, figs 4-8.
2011	*Ondina diaphana* (Jeffreys, 1848) – Hernández *et al*., p. 264, figs 90C-D.
2013	*Ondina diaphana* (Jeffreys, 1848) – Öztürk *et al*., p. 153, fig. 27.
2014	*Ondina diaphana* (Jeffreys, 1848) – Høisæter, p. 47, fig. 80.
2014	*Ondina diaphana* (Jeffreys, 1848) – Giannuzzi-Savelli *et al*., p. 50, figs 86-87, appendix p. 10, 57.
2018	*Ondina diaphana* (Jeffreys, 1848) – Trigo *et al*., p. 362, fig. 34.
non 1986	*Evalea diaphana* (Jeffreys, 1848) – Fretter *et al*., p. 583. figs 397-398 [= *Ondina perezi* (Dautzenberg & Fischer, 1925), *fide* Høisæter, 2014].
non 1988	*Evalea diaphana* (Jeffreys, 1848) – Graham, p. 568. fig. 245 [= *Ondina perezi* (Dautzenberg & Fischer, 1925), *fide* Høisæter, 2014].
non 1991	*Ondina diaphana* (Jeffreys, 1848) – Warén, p. 103. fig. 34B [= *Ondina perezi* (Dautzenberg & Fischer, 1925), *fide* Høisæter, 2014].

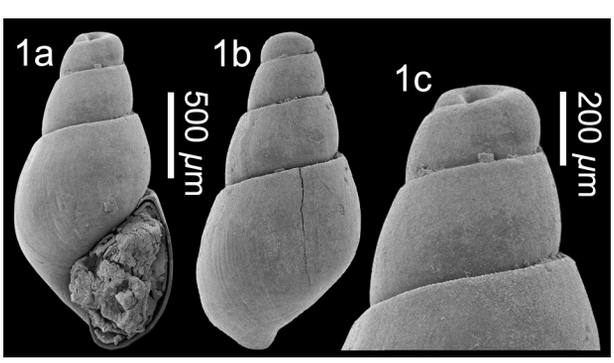

Plate 48. *Ondina diaphana* (Jeffreys, 1848); 1. NHMW 2019/0167/0608, height 1.9 mm, width 915 μm, 1c, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 1.9 mm, width 915 μm. **EL**: NHMW 2019/0167/0608-0609 (2).

Discussion – *Ondina diaphana* (Jeffreys, 1848) is characterised by its elongate-ovoid shell, strongly intorted type C protoconch, teleoconch of up to five weakly convex whorls, separated by a deeply impressed, strongly oblique suture, sinuous growth lines, absence of spiral sculpture, last whorl inflated, regularly convex, with deep umbilical chink. The aperture is pyriform, outer lip sinuous in profile, the columella erect abapically bearing a weak fold deep within.
Odontostomia (*Auristomia*) *perezi* Dautzenberg & Fischer, 1925 has been synonymised with *O. diaphana* by some authors (Warén, 1980a, 1991; Fretter *et al*., 1986; Micali, 1995; Peñas & Rolán, 1999a, *inter alia*) or considered separate species by others (Van Aartsen, 1987; Schander, 1995; Schander *et al*., 2003; Høisæter, 2014). *Ondina perezi* was said to differ in being larger, with a less glossy surface, less convex whorls, and a less distinct umbilicus. For latest discussion see Høisæter (2014, p. 48).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Norway and Sweden (Høisæter, 2014), northwestern Spain (Trigo *et al*., 2018), south to West Africa, Canaries (Van Aartsen *et al*., 1998; Hernández *et al*., 2011) to Mauritania (Peñas & Rolán, 1999a), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2013).

***Ondina* cf. *micropeas* (Boettger, 1902)**
Plate 49, fig. 1

cf. *1902	*Odostomia* (*Ondina*) *micropeas* Boettger, p. 100.
cf. 1934	*Macrostomia micropeas* Boettger – Zilch, p. 237, pl. 11, fig. 12.
2020	*Ondina* cf. *micropeas* (Boettger, 1902) – Landau *et al*., p. 298, pl. 22, figs 1-3.

Material and dimensions – Height 6.9 mm, width 2.9 mm. **EL**: NHMW 2019/0167/0477 (1), NHMW 2019/0167/0684 (1).

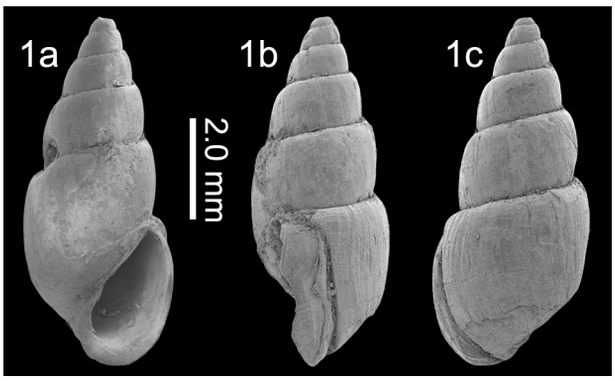

Plate 49. *Ondina* cf. *micropeas* (Boettger, 1902); 1. NHMW 2019/0167/0477, height 6.9 mm, width 2.9 mm (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Discussion – A single specimen of a relatively large *Ondina* species from El Lobillo seems to be conspecific with the species recorded by Landau *et al*. (2020, p. 298, pl. 22, figs 1-3) as *Ondina* cf. *micropeas* (Boettger, 1902). Unfortunately, the protoconch is not preserved, but the teleoconch is composed of five convex whorls separated by a relatively deeply impressed suture, the last whorl is large and inflated, 63% of total height, and the columella is short and excavated, with a robust fold at its adapical end. The surface is somewhat abraded, but is covered in fine spiral threads, most clearly preserved towards the aperture (Pl. 49, fig 1b).
It is closely similar to *Ondina micropeas* (Boettger, 1902) from the middle Miocene Paratethys of Romania, but differs in being higher spired. We have not seen that species, but the lectotype illustrated by Zilch (1934, pl. 11, fig. 12) does not show any spiral sculpture. However, as in the material at hand, the microsculpture is abraded in specimens that are not fresh. Boettger clearly described the spiral microsculpture "*…microscopice densissime spiraliter striati,…*" (1902, p. 100) in his species.

Distribution – Upper Miocene: Atlantic, NW France (Landau *et al*., 2020). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Ondina mosti* Van Aartsen, Gittenberger & Goud, 1998**
Plate 50, figs 1-2

*1998	*Ondina mosti* Van Aartsen, Gittenberger & Goud, p. 18, fig. 18.
1999a	*Ondina mosti* Aartsen, Gittenberger y Goud, 1998 – Peñas & Rolán, p. 129, figs 317, 318.
2005	*Ondina mosti* Aartsen, Gittenberger y Goud, 1998 – Rolán, p. 187, fig. 873.
2014	*Ondina* cf. *mosti* Aartsen, Gittenberger y Goud, 1998 – Peñas *et al*., p. 164, figs 21A-M (juvenile).

Material and dimensions – Maximum height 2.2 mm, width 1.0 mm. **VC**: NHMW 2019/0167/0171-0172 (2), NHMW 2019/0167/0478 (5).

Discussion – *Ondina mosti* Van Aartsen, Gittenberger & Goud, 1998 is characterised by its elongate-ovoid shell, strongly intorted type C protoconch, teleoconch of 3-3.5 moderately convex whorls, separated by an impressed, but not deep, suture, orthocline growth lines, sinuous towards the adapical suture, 4-5 spirals confined to the abapical half of the whorls, last whorl inflated, regularly convex, with another ten spirals on the base, and a narrow umbilical chink. The aperture is pyriform, the columella erect abapically bearing a weak fold mid-aperture. As discussed by Van Aartsen *et al*. (1998, p. 18), it differs from its eastern Atlantic/Mediterranean congeners in being less slender, with a proportionately larger and more inflated last whorl and shorted, less telescopic spire. It is most similar to *O. divisa* (J. Adams, 1797), but shells of that species are slenderer conical with last whorl occupying about 63-67% against about 75% of total height (see Warén, 1991, fig. 39D, Giannuzzi-Savelli *et al*., 2014, figs 91, 92).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic Cape Verde Islands (Van Aartsen *et al*., 1998; Rolán, 2005), Madeira and Selvagens Islands (Peñas & Rolán, 1999a; Segers *et al*., 2009).

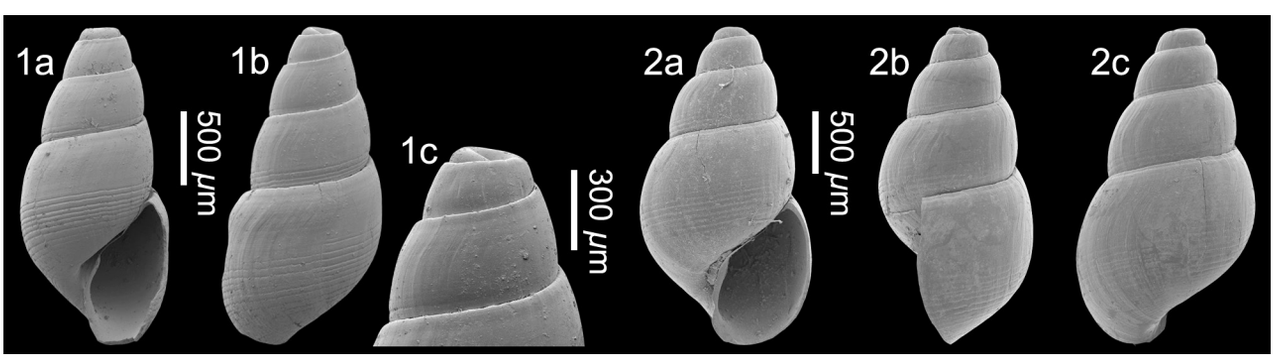

Plate 50. *Ondina mosti* Van Aartsen, Gittenberger & Goud, 1998; 1. NHMW 2019/0167/0171, height 2.2 mm, width 1.0 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0172, height 2.5 mm, width 1.4 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Ondina pinguis* nov. sp.**
Plate 51, figs 1-2

Type material – Holotype NHMW 2019/0167/0610, height 2.1 mm, width 955 μm; paratype 1 NHMW 2019/0167/0778, height 1.7 mm, width 840 μm.

Other material – Known from type series only.

Type locality – El Lobillo, Estepona, Spain.

Type stratum – lower Piacenzian, upper Pliocene.

Etymology – Latin '*pinguis, -e*', adjective reflecting its rather stout solid shape. *Ondina* gender feminine.

Diagnosis – *Ondina* species of minute size, subcylindrical, type C protoconch, three convex teleoconch whorls, sinuous axial growth lines, barrel-shaped last whorl.

Description – Shell minute, subcylindrical. Protoconch type C, strongly depressed. Teleoconch of three convex whorls, with periphery at one-third whorl height, separated by a deeply impressed, linear suture. Last whorl barrel-shaped, almost straight-sided mid-whorl, rounded at base. Smooth, except for sinuous axial growth lines. Aperture pyriform, outer lip slightly flared abapically. Columella erect and slightly everted, forming medial border of marked umbilical chink (columellar edge obscured by callus).

Discussion – Although represented by few specimens, this species is so distinctive that it warrants formal description. It is placed in the genus *Ondina* de Folin, 1870 based on its shell shape and sinuous axial growth lines. It is closely similar to the specimen from the Cape Verde Islands illustrated by Peñas & Rolán (1999a, p. 112, figs 297-299) as *Odostomia* sp. 1, but has less convex whorls. In our opinion, the West African shell might also be better placed in the genus *Ondina*.

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

***Ondina warreni* (Thompson, 1845)**
Plate 52, figs 1-2

*1845 *Rissoa Warreni* W. Thompson, p. 315, pl. 19, fig. 4.
1850 *Odostomia decorata* Jeffreys, p. 109.
1872 *Ondina semiornata* de Folin *in* de Folin & Périer, p. 48, pl. 2, fig. 1.
1884 *Auriculina scandens* Monterosato, p. 97.
1891 *Ptychostomon Marioni* Locard, p. 148.
1972b *Evalea scandens farolita* Nordsieck, p. 103, pl. PII, fig. 22.
1972b *Evalea subulata* Nordsieck, p. 103, pl. PII, fig. 23.
1972b *Evalea alleryi* Nordsieck, p. 103, pl. PII, fig. 24.
1972b *Evalea warreni* (Thompson, 1845) – Nordsieck, p. 104, pl. III, fig. 1.
1923 *Odostomia* (*Ondina*) *Warreni* (Thompson) – Harmer, p. 838, pl. 64, fig. 19.
1984 *Ondina warreni scandens* (Monterosato, 1884) – Van Aartsen *et al*., p. 53, fig. 256.
1987 *Ondina warreni* (Thompson, 1845) – Van Aartsen, p. 17, 19, fig. 49.
1988 *Evalea warreni* (Thompson, 1845) – Graham, p. 572, fig. 247.
1995 *Ondina warreni* (Thompson, 1845) – Micali, p. 17, figs 2-5.
1996 *Ondina warreni* (Thompson, 1845) – Peñas *et al*., p. 57, figs 145-147.
2001 *Ondina warreni* (Thompson, 1845) – Cachia *et al*., p. 108, pl. 18, fig. 1.
2011 *Ondina warreni* (Thompson, 1845) – Chirli & Micali, p. 70, pl. 24, figs 9-15 (*cum syn*.).
2011 *Ondina warreni* (Thompson, 1845) – Chirli & Linse, p. 204, pl. 79, fig. 2.
2011 *Ondina warreni* (Thompson, 1845) – Hernández *et al*., p. 264, figs 90G-H.
2013 *Ondina warreni* (Thompson, 1845) – Öztürk *et al*., p. 155, fig. 29A-C.
2014 *Ondina warreni* (Thompson, 1845) – Høisæter, p. 46, figs 78-80.
2014 *Ondina warreni* (W. Thompson, 1845) – Giannuzzi-Savelli *et al*., p. 52, figs 101-105, appendix p. 12, 60.
2018 *Ondina warreni* (W. Thompson, 1845) – Trigo *et al*., p. 362, fig. 37.

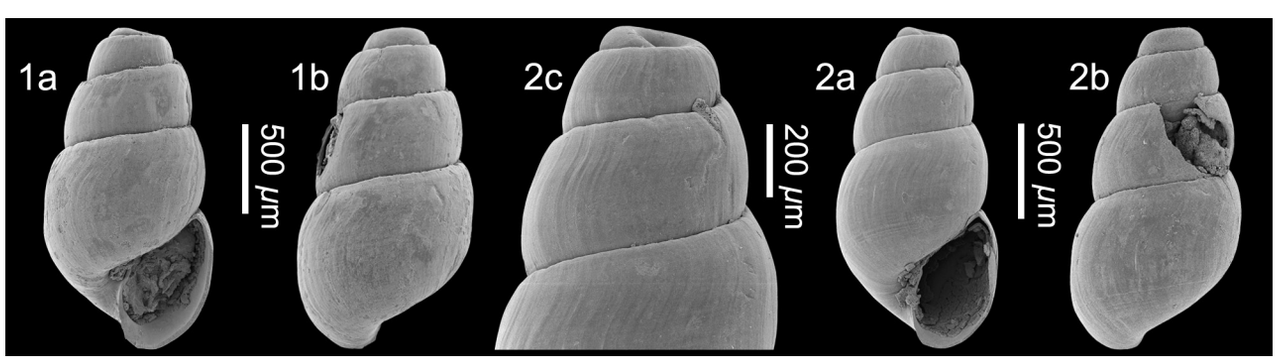

Plate 51. *Ondina pinguis* nov. sp.; 1. **Holotype** NHMW 2019/0167/0610, height 2.1 mm, width 955 μm; 2. **Paratype 1** NHMW 2019/0167/0778, height 1.7 mm, width 840 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

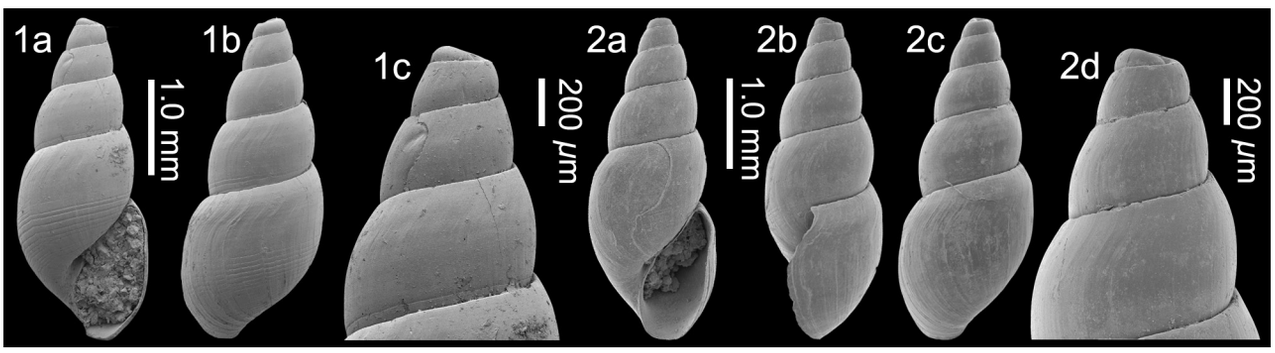

Plate 52. *Ondina warreni* (Thompson, 1845); 1. NHMW 2019/0167/0105, height 3.4 mm, width 1.4 mm, 1c, detail of protoconch; NHMW 2019/0167/0106, height 3.6 mm, width 1.4 mm, 2d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 3.6 mm, width 1.4 mm. **VC**: NHMW 2019/0167/0105-0106 (1), NHMW 2019/0167/0459 (34). **EL**: NHMW 2019/0167/0416 (30).

Discussion – *Ondina warreni* (Thompson, 1845) is characterised by its small size, type C protoconch, teleoconch of 'telescopic' form, about five convex whorls separated by a deeply impressed suture. Spiral sculpture is most evident over the base, but finer spirals can cover most of the later whorl surface. The last whorl is regularly convex, with a very narrow, but deep umbilicus. The aperture is pyriform, the columella erect abapically with columellar fold very weak or absent.
Several similar *Ondina* species with spiral sculpture occur in the European assemblages. *Ondina divisa* (J. Adams, 1797) has an oblongo-conical profile as opposed to "telescopic", the protoconch is larger, more strongly intorted and depressed, teleoconch whorls are less inflated and the spiral groves are deeper.
Ondina coarctata (Sars, 1878) is a northern European species that has equally fine spirals covering the entire surface. *Ondina warreni* is most like the Mediterranean *O. neocrystallina* Gaglini, 1992, but that species has more globose convex whorls separated by a deeper suture, a relatively taller last whorl and aperture, and the spiral grooves are shallower. We note that *O. neocrystallina*, whilst accepted by some authors (Giannuzzi-Savelli *et al*., 2014), was synonymised with *O. warreni* by others (Peñas & Rolán, 1999a). *Ondina cerullii* (Cossmann, 1921) has a more solid shell, less convex whorls separated by a less impressed suture and the spirals on the base are coarser.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0337); western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: North Sea Basin, St. Erth, England (Harmer, 1923); central Mediterranean, Italy (Di Geronimo *et al*., 1982; Rindone & Vazzana, 1989; Brunetti, 2011). Lower Pleistocene: eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: eastern Atlantic frontage Scandinavia (Høisæter, 2014), northwestern Spain (Trigo *et al*., 2018), southwards into entire Mediterranean, Madeira and Selvagens Islands (Segers *et al*., 2009), Canary Islands (Nordsieck, 1972b; Graham, 1988; Micali & Palazzi, 1992; Peñas *et al*., 1996; Van Aartsen *et al*., 2000; Cachia *et al*., 2001; Hernández *et al*., 2011; Öztürk *et al*., 2013; Høisæter, 2014).

Genus *Pseudoscilla* Boettger, 1902

Type species – *Oscilla* (*Pseudoscilla*) *miocaenica* Boettger, 1902, by monotypy, Miocene, Romania.

1902 *Pseudoscilla* Boettger, p. 113.
1921 *Miraldiella* Cossmann, p. 263. Type species (by monotypy): *Parthenia exarata* Carpenter, 1856, present-day, Mazatlan, Pacific Mexico.

***Pseudoscilla* aff. *bussanensis* Sosso, Dell'Angelo & Bonfitto, 2009**
Plate 53, fig. 1

cf. *2009 *Pseudoscilla bussanensis* Sosso, Dell'Angelo & Bonfitto, p. 105, figs 2A-F.

Material and dimensions – Height 2.0 mm, width 1.1 mm. **PA**: NHMW 2019/0167/0090 (1).

Discussion – A single incomplete specimen represents a *Pseudoscilla* Boettger, 1902 species with a type B protoconch, teleoconch composed of three whorls, sculptured by two strongly elevated spiral carinae on spire whorls, the adapical carina placed just below the suture, the abapical one just below mid-whorl. The last whorl has a third strong cord developed at the level of the insertion of the outer lip, and a fourth weaker cord mid-base. Fine orthocline axial growth lines are visible in the interspaces between the carinae. There are also some subobsolete spirals above and below the carinae. Unfortunately, the specimen is incomplete, missing the outer lip and siphonal fasciole, and despite intensive searching, a second specimen remains elusive. It is closely similar to

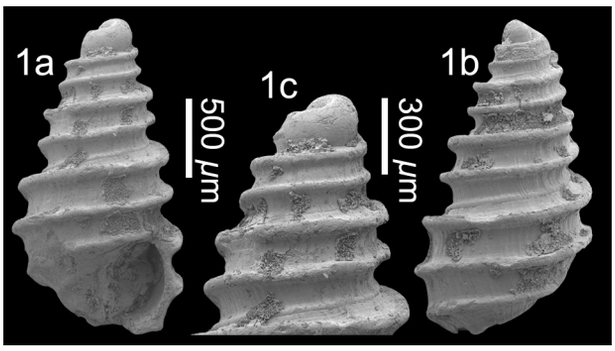

Plate 53. *Pseudoscilla* aff. *bussanensis* Sosso, Dell'Angelo & Bonfitto, 2009; 1. NHMW 2019/0167/0090, height 2.0 mm, width 1.1 mm, 1c, detail of protoconch (SEM image). Rio del Padrón, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Pseudoscilla bussanensis Sosso, Dell'Angelo & Bonfitto, 2009 from the Italian Pliocene. Those authors kindly compared the Estepona specimen with the Italian species and concluded that they may not be conspecific: the Estepona species, being squatter, the spiral sculpture on the carinae is weaker, and the axial growth lines less well developed (M. Sosso, personal communication BL, 2020). This position is accepted, and with the single incomplete specimen from Estepona, we can comment no further. *Pseudoscilla bilirata* (de Folin, 1870) from present-day West Africa (see Peñas *et al*., 2014, p. 130, figs 8A-D) is taller spired and slenderer than any of the fossil shells and has even stronger axial sculpture.

Pseudoscilla is a thermophilic pyramidellid genus, today in the eastern Atlantic restricted to the Tropical coasts of West Africa, not occurring north of the Canary Islands (Peñas & Rolán, 2014, p. 130) that in the Pliocene had a more northern distribution, extending their range into the western Mediterranean. It also occurs in the Western Atlantic (Odé, 1993; Pimenta *et al*., 2008), Red Sea (Peñas *et al*., 2020) and eastern Pacific [*Pseudoscilla exarata* (Carpenter, 1857) nov. comb. *fide* Pat LaFollette pers. comm. 18/09/2021].

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

Tribe Chrysallidini Saurin, 1958
Genus *Chrysallida* Carpenter, 1856

Type species – *Chemnitzia communis* C.B. Adams, 1852, by original designation, present-day, Panamic Pacific.

1856 *Chrysallida* Carpenter, p. 170.

Note – "*The species of the genus* Chrysallida *are characterised by rissoid shells with intorted protoconch whorls, with or without a tooth on the columella, and with axial and spiral ribs of about equal strength*" (Van Aartsen *et al*., 2000, p. 20).

As notes by those authors, *Chrysallida* is no longer represented in the present-day European Atlantic and Mediterranean waters, with only a few species extant in the Canary Islands (Nordsieck & García-Talavera, 1979) and Cape Verde Islands (Van Aartsen *et al*., 2000). In the Pliocene Mediterranean it is represented by *C. craticulata* (De Stefani & Pantanelli, 1878).

***Chrysallida craticulata* (De Stefani & Pantanelli, 1878)**
Plate 54, figs 1-4

*1878 *Menestho craticulata* De Stefani & Pantanelli, p. 43.
1984 *Chrysallida* sp. – Chirli, p. 31, fig. 9.
1992a *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Crovato & Micali, p. 123, 131, pl. 1, fig. 6.
1992b *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Crovato & Micali, p. 136, 138, pl. 2, fig. 2.
1992 *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Micali, p. 198, fig. 6.
2008 *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Chirli & Micali, p. 40, figs 1A-B.
2010 *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Sosso & Dell'Angelo, p. 51, unnumbered fig. p. 66, bottom row centre.
2011 *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Chirli & Micali, p. 21, pl. 6, figs 6-10.
2018 *Chrysallida craticulata* (De Stefani & Pantanelli, 1878) – Brunetti & Cresti, p. 104, fig. 446.
2018 *Chrysallida incerta* (Milaschewitsch, 1916) – Brunetti & Cresti, p. 104, fig. 447 [*non Spiralina incerta* (Milaschewitsch, 1916) = *Spiralina alpinoligustica* (Sacco, 1892)].

Material and dimensions – maximum height 2.3 mm, width 1.0 mm. **EL**: NHMW 2019/0167/00660-0663 (4), NHMW 2019/0167/0664 (50+).

Revised description (based on Estepona material) – Shell small, ovate. Protoconch type B. Teleoconch of four convex whorls, separated by deeply incised, undulating suture. Sculpture of broad, rounded prosocline axial ribs, 16 on penultimate whorl, roughly equal in width to their interspaces, overrun by four weaker, broad spiral cords, broader than their interspaces; cords slightly swollen over axial intersections. Last whorl 57-63% total height, convex, roundly and weakly angled at periphery, axial ribs ending abruptly at fourth cord and weakening over last half whorl; base delimited by smooth, broad peribasal cord, with four further smooth, broad cords over base. Aperture ovate, peristome complete, outer lip slightly expanded abapically. Columella strongly oblique, thickened abapically, bearing weak fold mid-height. Narrow umbilical chink present.

Discussion – This species has been found only at the El Lobillo locality in the Estepona assemblage and shows remarkable variability. The teleoconch sculpture is rather irregular and tends towards obsolescence on the last half whorl. The axial component is predominant, sometimes

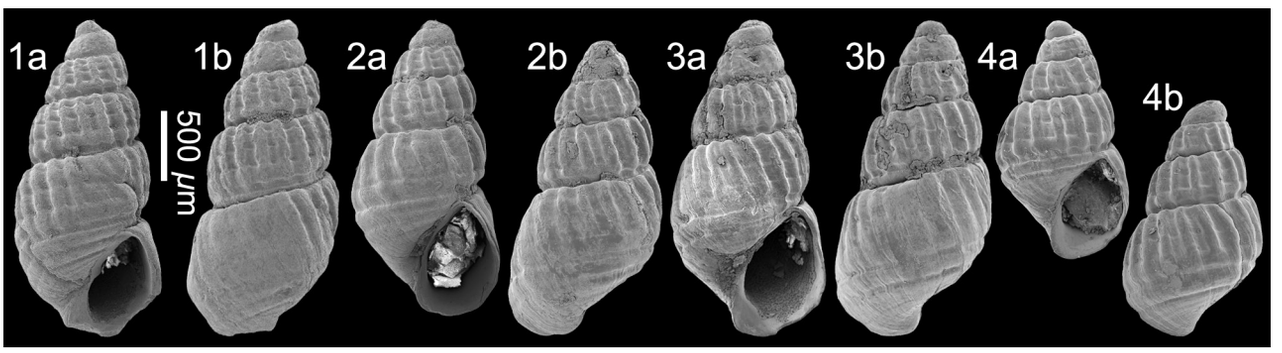

Plate 54. *Chrysallida craticulata* (De Stefani & Pantanelli, 1878); 1. NHMW 2019/0167/00660, height 2.3 mm, width 1.0 mm; 2. NHMW 2019/0167/0661, height 2.1 mm, width 1.0 mm; 3. NHMW 2019/0167/0662, height 2.3 mm, width 1.1 mm; 4. NHMW 2019/0167/0663 (juvenile), height 1.7 mm, width 975 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

strongly so, and the cords tend to be flattened and weaker than the ribs. We cannot separate it satisfactorily from the Italian Pliocene species *Chrysallida craticulata* (De Stefani & Pantanelli, 1878), although most Estepona specimens have the ribs more strongly developed, the cords weaker, and weaker tubercles developed at the sculptural intersections. However, the same degree of variability is seen in Estepona and Italy.

It is most similar in profile and teleoconch sculpture to *C. canariensis* Nordsieck & García-Talavera, 1979 from the Canary Islands, but that species is immediately separated by its strongly spirally striate protoconch and the teleoconch sculpture is stronger and more regular, with well-defined rounded tubercles developed at the sculptural intersections. *Chrysallida carpinei* Van Aartsen, Gittenberger & Goud, 2000 from the Cape Verde Islands is also similar in shape, but has a strongly carinate protoconch. Like *C. craticulata* the axials are predominant, but stronger tubercles are developed at the sculptural intersections. *Chrysallida minutissima* (Dautzenberg & Fischer, 1907), *C. macmillanae* Van Aartsen, Gittenberger & Goud, 2000 and C. *horii* Van Aartsen, Gittenberger & Goud, 2000, all from the Cape Verde Islands have a slenderer shell. *Chrysallida hoenselaari* Van Aartsen, Gittenberger & Goud, 2000, also from Cape Verde, has the finest sculpture of the group. For comparison with *Chrysallida minutissima* see Peñas & Rolán (1998 p. 6).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli, 1984; Crovato & Micali, 1992a, 1992b; Micali, 1992; Chirli & Micali, 2008, 2011; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sosso & Dell'Angelo, 2010).

Genus *Euparthenia* Thiele, 1929

Type species – *Parthenia bulinea* Lowe, 1841, by typification of replaced name, present-day, Madeira.

1841 *Parthenia* Lowe, p. 39 (*pro parte*). Type species (by subsequent designation, Monterosato, 1881, p. 255): *Parthenia bulinea* Lowe, 1841, present-day, Madeira. *Non* Robineau-Desvoidy, 1830 [Diptera].

1929 *Euparthenia* Thiele, p. 233. *Nom. nov. pro Parthenia* Lowe, 1841, *non* Robineau-Desvoidy, 1830 [Diptera].

Note – Thiele (1929, p. 233) introduced *Euparthenia* explicitly as a replacement name for *Parthenia* Lowe, 1841 (part), *non* Robineau-Desvoidy, 1830 [Diptera]. Although Bucquoy, Dautzenberg & Dollfus (1883) also introduced a name, *Parthenina*, to take the place of *Parthenia* Lowe, they did so explicitly as a new subgenus, not as a replacement name, designating as type *Turbo interstinctus* J. Adams, 1797, a species not among those originally included in *Parthenia* by Lowe. We consider *Parthenia bulinea* Lowe, 1841 and *Turbo interstinctus* J. Adams, 1797 to represent distinct genera. See below under *Parthenina* for further discussion.

***Euparthenia bulinea* (Lowe, 1841)**
Plate 55, fig. 1

1837 *Tornatella elongata* Philippi, p. 292, pl. 3, figs 4, 5 (*non* J. de C. Sowerby, 1836).
*1841 *Parthenia bulinea* Lowe, p. 40.
1844 *Chemnitzia Humboldti* var. *gracilis* Philippi, p. 137.
1856 *Littorina striata* Danilo & Sandri, p. 128
1868 *Odostomia dissimilis* Tiberi, p. 62.
1903 *Pyramidella aprustica* Crema, p. 261, pl. 3, fig. 17.
1972b *Kleinella* (*Euparthenia*) *bulinea* (Lowe, 1841) – Nordsieck, p. 101, pl. PII, figs 16, 17.
1985b *Miralda bulinea* (Lowe, 1840) – Micali, p. 44, fig. 3.
1996 *Euparthenia bulinea* (Lowe, 1841) – Peñas *et al*., p. 31, fig. 55.
2001 *Euparthenia bulinea* (Lowe, 1841) – Cachia *et al*., p. 91, pl. 14, fig. 9.
2014 *Euparthenia bulinea* (Lowe, 1841) – Giannuzzi-Savelli *et al*., p. 58, fig. 133, appendix p. 15, 63.

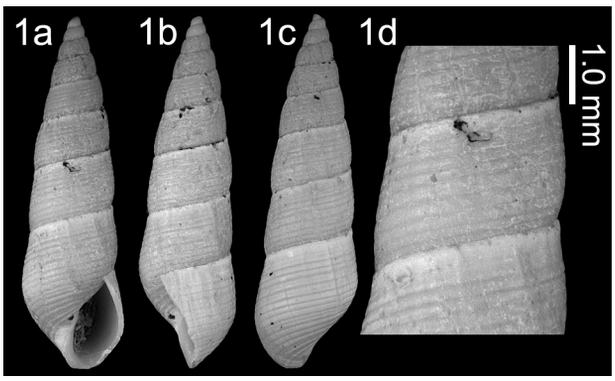

Plate 55. *Euparthenia bulinea* (Lowe, 1841); 1. NHMW 2019/0167/0181, height 13.7 mm, width 3.9 mm, 1d, detail of teleoconch sculpture penultimate whorl. El Lobillo, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 13.7 mm, width 3.9 mm. **EL**: NHMW 2019/0167/0181 (1), NHMW 2019/0167/0182 (1).

Discussion – The genus *Euparthenia* Thiele, 1929 comprises a small number of relatively large shelled pyramidellid species that today are represented by two species in European waters; *E. bulinea* (Lowe, 1841) and *E. humboldti* (Risso, 1826), that differs from *E. bulinea* in being smaller, with a wider apical angle, more convex whorls, the last whorl is more inflated and the axial growth lines interrupt the spirals giving the sculpture a gemmate appearance. The protoconch in both species is of type B (Peñas *et al*., 1996, p. 31).
The specimens illustrated by Chirli & Micali (2011, pl. 39, figs 4-9) from the lower Pliocene of Tuscany, Italy as *Euparthenia* aff. *humboldti* are problematic. The specimens from Tuscany differ from *E. bulinea* in their stouter profile, sculpture with fewer spiral grooves, whereas *E. bulinea* has flat cords separate by interspaces of similar width. These Italian specimens are more likely to represent *E. miohumboldti* (Sacco, 1892), which was based on the specimen from the middle Miocene Paratethys figured by Hörnes (1856, p. 506, pl. 43, fig. 34), and also figured by Friedberg (1928, pl. 28, fig. 13) from the Paratethys of Poland.
For comparison with Atlantic Miocene congeners see Ceulemans *et al.* (2018, p. 129).
Euparthenia galaaensis Fekih, 1969 from the lower Pliocene of Tunisia (height 2.05 mm) is possibly based on a specimen of *Liamorpha elegans* (de Folin, 1870), which has strong axial sculpture on the adapical half of the whorls, and is quite different from *Euparthenia*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Madeira and Selvagens Islands (Nordsieck, 1972b; Segers *et al*., 2009), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

Genus *Ividella* Dall & Bartsch, 1909

Type species (by original designation) – *Odostomia* (*Ividia*) *navisa* Dall & Bartsch, 1904, present-day, Californian and Panamic Pacific.

1884 *Funicularia* Monterosato, p. 85. Type species (by subsequent designation, Dall & Bartsch, 1909, p. 172): *Rissoa excavata* Philippi, 1836, present-day, Mediterranean (*non* Forbes, 1846 [Cnidaria: Pennatulidae]). Also unavailable due to being proposed conditionally fide Gofas pers. com. 2012 (Landau & LaFollette, 2015, p. 23); Dall & Bartsch, 1909, p. 172, senior homonym '*Funicularia* Lamarck' is probably an error for *Furcularia* Lamarck, 1816 [Rotifera].
1907 *Ividia* spp. of Dall & Bartsch, p. 517 (based on a misinterpretation of the type species, *Parthenia armata* Carpenter, 1857).
1909 *Ividella* Dall & Bartsch, pp. 14, 172.

Note – Generic placement of the European species *Rissoa excavata* Philippi, 1836 remains controversial. Most authors have placed it in the genus *Folinella* Dall & Bartsch, 1904. However, Landau & LaFollette (2015, p. 24) argued for placement in the genus *Ividella* Dall & Bartsch, 1909, as done by some earlier European authors (Fretter *et al*., 1986; Graham, 1988, p. 560). Penãs & Rolán (2017, p. 63) again highlighted the controversy and placed *Ividella* in synonymy with *Folinella* with a question mark. They argued for the use of *Folinella* "…the type species *Odostomia* (*Ividia*) *navisa* Dall & Bartsch, 1904 superficially resembles *Folinella excavata* but also has a type B protoconch instead of type C, therefore its treatment as congeneric with the latter is no more convincing than for *F. anguliferens*." (Peñas & Rolán, 2017, p. 63). Until molecular data is available to resolve this matter, we prefer to include these species in the genus *Ividella*.
Ividella Dall & Bartsch, 1909 species are characterised by having shells with elevated ribs, spiral sculpture formed by cords almost equal in strength to the ribs that overrun them forming a strongly reticulated surface sculpture, and a base with some spiral cords, but no axials. The protoconch is of type B or C.

***Ividella excavata* (Philippi, 1836)**
Plate 56, figs 1-2

*1836 *Rissoa excavata* Philippi, p. 154.
1882 *Odostomia excavata* Philippi – Bucquoy *et al*., p. 177, pl. 19, figs 16, 17.
1892a *Pyrgulina* (*Miralda*) *excavata* var. *turritastensis* Sacco, p. 70, pl. 1, fig. 116.
1914 *Parthenina* (*Miralda*) *excavata* Phil. – Cerulli-Irelli, p. 265 [439], pl. 23 [55], figs 15-17.
1920 *Miralda excavata* (Philippi) – Harmer, p. 580, pl. 49, fig. 50.
1960 *Chrysallida* (*Ividella*) *excavata* (Philippi) – Pelosio, p. 147, pl. 2, fig. 1.

1971 *Chrysallida* (*Parthenina*) *excavata* (Philippi) – Greco, p. 288, pl. 4, figs 6, 7.
1972b *Chrysallida* (*Ividella*) *excavata* (Philippi, 1836) – Nordsieck, p. 98, pl. PII, fig. 5.
1977 *Chrysallida excavata* (Philippi, 1836) – Van Aartsen, p. 50, 58, pl. 1, fig. 3.
1984 *Chrysallida excavata* (Philippi, 1836) – Chirli, p. 25, fig. 3.
1986 *Ividella excavata* (Philippi, 1836) – Fretter *et al*., p. 571, figs 388, 389.
1987 *Chrysallida* (*Parthenina*) *excavata* (Philippi 1836) – Cuerda Barceló, 326, pl. 30, fig. 10.
1988 *Ividella excavata* (Philippi, 1836) – Graham, p. 560, fig. 241.
1992 *Chrysallida excavata* (Philippi, 1836) – Van der Linden & Eikenboom, p. 45, figs 58, 59.
1992 *Folinella excavata* (Philippi, 1836) – Cavallo & Repetto, p. 154, fig. 431.
1992a *Folinella excavata* (Philippi, 1836) – Crovato & Micali, p. 121.
1996 *Chrysallida excavata* (Philippi, 1836) – Peñas *et al*., p. 18, figs 60-61.
2001 *Folinella excavata* (Philippi, 1836) – Cachia *et al*., p. 92, pl. 14, fig. 11.
2010 *Folinella excavata* (Philippi, 1836) – Sosso & Dell'Angelo, p. 52, 67, top row 2nd fig.
2011 *Chrysallida excavata* (Philippi, 1836) – Chirli & Micali, p. 24, pl. 8, figs 1-5 (*cum syn*.).
2011 *Chrysallida excavata* (Philippi, 1836) – Chirli & Linse, p. 194, pl. 72, fig. 3.
2011 *Chrysallida excavata* (Philippi, 1836) – Öztürk *et al*., p. 60, fig 6A-D.
2011 *Chrysallida excavata* (Philippi, 1836) – Hernández *et al*., p. 249, figs 85U-V.
2014 *Folinella excavata* (Philippi, 1836) – Giannuzzi-Savelli *et al*., p. 60, figs 136-137, appendix p. 16, 63.
2014 *Folinella excavata* (Philippi, 1836) – Peñas *et al*., p. 124, figs 6F-I.
2018 *Folinella excavata* (Philippi, 1836) – Brunetti & Cresti, p. 106, fig. 462.
2018 *Chrysallida excavata* (Philippi, 1836) – Trigo *et al*., p. 361, fig. 1.
2020 *Folinella excavata* (Philippi, 1836) – Landau *et al*., p. 302, pl. 26, fig. 1.

Material and dimensions – Maximum height 5.3 mm, width 2.2 mm. **CO**: NHMW 2019/0167/0074 (5), NHMW 2019/0167/0471 (1). **VC**: NHMW 2019/0167/0075 (1), NHMW 2019/0167/0076 (1). **EL**: NHMW 2019/0167/0792 (1).

Discussion – *Ividella excavata* (Philippi, 1836) is a distinctive species, with its strongly elevated axials and spirals forming coarse cancellate sculpture, with small, rounded tubercles developed at the intersections. The protoconch is of type B, tending to C, and sharply delimited. *Folinella ghisottii* Van Aartsen, 1984 from the present-day Mediterranean differs in having a squatter shell and three primary cords on the last whorl, the central cord somewhat weaker.

Distribution – Upper Miocene (Tortonian): NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Chirli, 1984; Crovato & Micali, 1992a; Guioli *et al*., 2009; Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0281-0282); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Greco, 1971; Cavallo & Repetto, 1992; Crovato & Micali, 1992a; Ragaini & Bernieri, 2007; Guioli *et al*., 2009; Sosso & Dell'Angelo, 2010; Chirli & Micali, 2011; Brunetti & Cresti, 2018). Lower Pleistocene: western Mediterranean, Balearic Islands (Cuerda Barceló, 1987); central Mediterranean, Italy (Cerulli-Irelli, 1914: Pelosio, 1960; Crovato & Micali, 1992a); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Holocene: Atlantic, Northern Ireland (Harmer, 1920). Present-day: Atlantic, Scotland (Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), Madeira and Selvagens Islands (Segers *et al*., 2009), to Canaries (Hernández *et al*., 2011), Senegal, Angola (Peñas & Rolán, 1998; Peñas *et al*., 2014), western Mediterranean (Bucquoy *et al*., 1882; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2011).

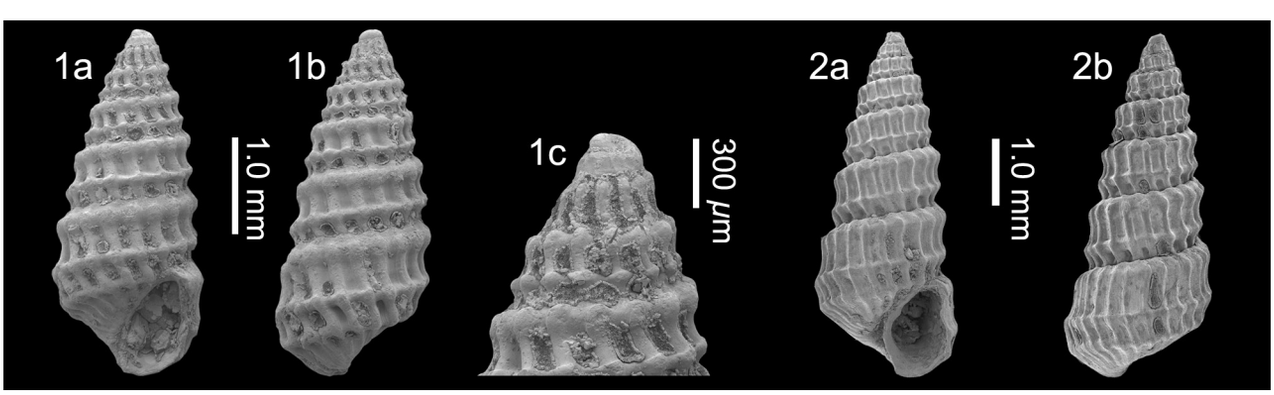

Plate 56. *Ividella excavata* (Philippi, 1836); 1. NHMW 2019/0167/0075, height 3.9 mm, width 1.1 mm, 1c, detail of protoconch. Velerín carretera. 2. NHMW 2019/0167/0471, height 5.3 mm, width 2.2 mm (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Ividella ghisottii* (Van Aartsen, 1984)**
Plate 57, figs 1-2

1869 *Odostomia intermedia* Brusina, p. 237 (*non* Deshayes, 1861).
1977 *Chrysallida intermedia* (Brus.) – Van Aartsen, p. 51, 58, pl. 1, fig. 4.
1984 *Chrysallida canaliculata* (Philippi, 1844) – Chirli, p. 24, fig. 1 (*non* Philippi, 1844).
*1984 *Folinella ghisottii* Van Aartsen, p. 137 (*nom. nov. pro Odostomia intermedia* Brusina, 1869, *non* Deshayes, 1861).
1992a *Folinella ghisottii* Van Aartsen, 1985 [*sic*] – Crovato & Micali, p. 123, 128, fig. 3.
1992 *Folinella ghisottii* Van Aartsen, 1984 – Micali, p. 197, pl. 1, fig. 7.
1996 *Chrysallida ghisottii* (Van Aartsen, 1984) – Peñas *et al*., p. 20, fig. 62.
1998 *Chrysallida ghisottii* (Van Aartsen, 1984) – Peñas & Rolán, p. 20, figs 56, 57.
2001 *Folinella ghisottii* Van Aartsen, 1984 – Cachia *et al*., p. 92, pl. 14, fig. 12.
2011 *Chrysallida ghisottii* (Van Aartsen, 1984) – Chirli & Micali, p. 29, pl. 9, figs 6-10.
2014 *Folinella ghisottii* Van Aartsen, 1984 – Giannuzzi-Savelli *et al*., p. 60, figs 138-139, appendix p. 16, 64.

Material and dimensions – Maximum height 2.0 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0781-0782 (2), NHMW 2019/0167/0783 (2).

Discussion – *Ividella ghisottii* (Van Aartsen, 1984) is closely similar to *I. excavata* (Philippi, 1836) (see above), but differs in being less slender, with a lower spire. The spiral sculpture consists of three cords, of which the adapical cord is stronger and the middle cord weaker than in *I. excavata*, and the number of axial ribs is greater.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli, 1984; Crovato & Micali, 1992a; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Senegal, Mauritania, Cape Verde Islands (Peñas & Rolán, 1998), into western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali, 1992).

Genus *Jordaniella* Chaster, 1898

Type species – *Turbo nivosus* Montagu, 1803, by subsequent designation (Chaster, 1901), present-day, British Isles.

1898 *Jordaniella* Chaster, p. 20.
1901 *Jordanula* Chaster, p. 8. Type species (by typification of replaced name): *Turbo nivosus* Montagu, 1803, by subsequent designation (Chaster, 1901), present-day, British Isles. Unnecessary *nom. nov. pro Jordanella* Goode & Bean, 1879 [Pisces].

Note – *Jordaniella* Chaster, 1898 species are characterised by their small almost cylindrical shells of no more than six whorls, small inverted type C protoconch, sculpture of spiral cords and growth lines, ovate aperture, and small columellar fold placed deep within the aperture. The molecular phylogeny of Schander *et al*. (2003) supported use of the genus, however, it was removed from the subfamily Odostomiinae Pelseneer, 1928 and placed in the Chrysallidini Saurin, 1958.

***Jordaniella truncatula* (Jeffreys, 1850)**
Plate 58, fig. 1

*1850 *Odostomia truncatula* Jeffreys, p. 109.
1980a *Jordaniella truncatula* (Jeffreys, 1850) – Warén, p. 39, pl. 6, fig. 21.
1986 *Jordaniella truncatula* (Jeffreys, 1850) – Fretter *et al*., p. 595, figs 409-411.
1987 *Odostomia* (*Jordaniella*) *truncatula* Jeffreys, 1850 – Van Aartsen, p. 7, fig. 9.
1988 *Jordaniella truncatula* (Jeffreys, 1850) – Graham, p. 580, fig. 251.
1998 *Odostomia* (*Odostomia*) *truncatula* Jeffreys, 1850 – Van Aartsen *et al*., p. 32, fig. 34.

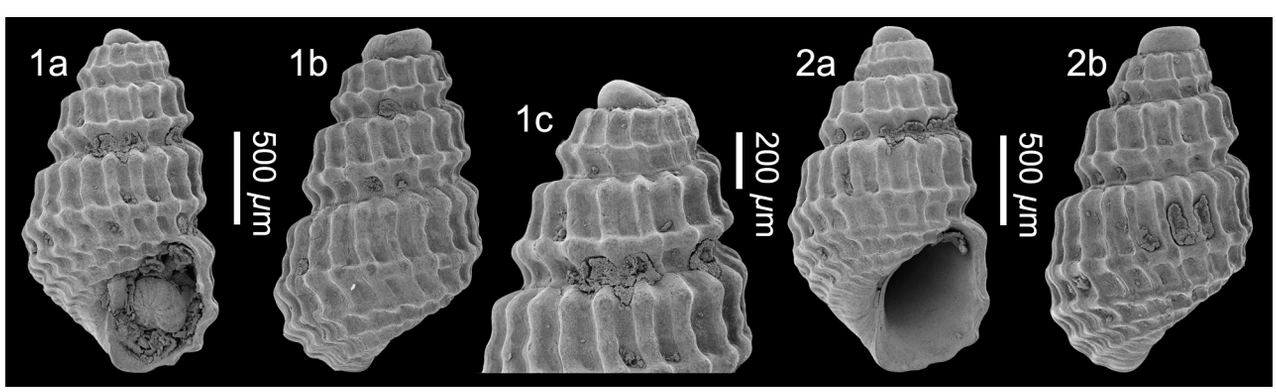

Plate 57. *Ividella ghisottii* (Van Aartsen, 1984); 1. NHMW 2019/0167/0782, height 1.9 mm, width 1.1 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0783, height 2.0 mm, width 1.1 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

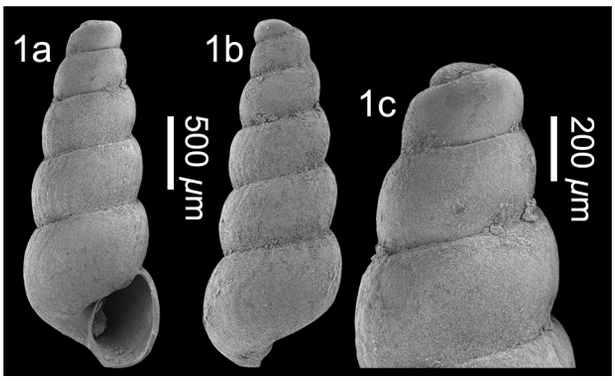

Plate 58. *Jordaniella truncatula* (Jeffreys, 1850); 1. NHMW 2019/0167/0763, height 2.4 mm, width 950 μm, 1c, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

2005 *Odostomia truncatula* Jeffreys, 1850 – Rolán, p. 185, fig. 919.
2014 *Jordaniella truncatula* (Jeffreys, 1850) – Høisæter, p. 42, fig. 70.

Material and dimensions – Height 2.4 mm, width 950 μm. **EL**: NHMW 2019/0167/0763 (1).

Discussion – *Jordaniella truncatula* (Jeffreys, 1850) is characterised by its tall slender, cylindrical shell, with truncated apex, type C protoconch, teleoconch of 5-6 convex whorls separated by a deep suture, sculpture of accentuated, slightly opisthocline, sinuous axial growth lines and weak spiral cords, more strongly developed on abapical half of whorls. sub-rectangular aperture, outer lip sinuous in profile and columella with a fold at its adapical end. The spiral sculpture can be very weak or subobsolete (see Van Aartsen *et al*., 1998, fig. 34). This species seems to be uncommon throught its range, and to our knowledge this is the first fossil record.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Norway (Høisaeter, 2014), British Isles (Fretter *et al*., 1986; Graham, 1988) south to West Africa, Cape Verde Islands (Van Aartsen *et al*., 1998; Rolán, 2005).

Genus *Lafolletteia* nov. gen.

Type species – *Rissoa obliquisculpta* Seguenza, 1880, Pliocene, Italy.

Other species included – "*Herewardia*" *osmagnum* Peñas & Rolán, 2017.

Diagnosis – Small, robust, squat, biconic shells, of few whorls, with low scalate spire. Protoconch type C or type C tending to B. Teleoconch of about 2-2.5 whorls separated by deeply impressed suture. First whorl almost flat-sided. Axial sculpture strongly predominant; very oblique and prosocline ribs develop on second half of first whorl, spiral cord developed on second half of first whorl in some species. Secondary spiral sculpture covers entire surface. Last whorl large and inflated, angled at strongly developed, rope-like, peribasal cord placed at level of insertion of outer lip; base weakly convex, with axials persisting over base, imperforate or very narrow umbilical chink. Aperture wide, outer lip angled at termination of peribasal cord, strongly and widely expanded abapically. Columella weakly excavated, without fold; columellar callus strongly thickened, abapically, narrowed in parietal area.

Etymology – Named after Patrick I. LaFollette of the Natural History Museum of Los Angeles, California in recognition of his enormous knowledge on pyramidellids and his unswerving support in our works documenting this group.

Discussion – Recent Italian authors have placed *Rissoa obliquisculpta* Seguenza, 1880 in the genus *Chrysallida* Carpenter, 1856 (Ceregato & Tabanelli, 2006; Sosso & Dell'Angelo, 2010; Brunetti & Cresti, 2018) together with other species that are herein placed in the genus *Parthenina* Bucquoy, Dautzenberg & Dollfus, 1883. Use of the genus *Chrysallida* or *Parthenina* for these European species was discussed by Landau & LaFollette (2015, p. 22). In any case, the shell thickness of *Rissoa obliquisculpta* Seguenza, 1880, profile and sculpture are quite different from those seen in species included in either of those two genera.
In robustness, profile and sculpture it is similar to species included in the genus *Herewardia* Iredale, 1955, known from Australia and the South Pacific. *Herewardia* is characterised by very robust shells composed of few whorls, type C protoconch, very oblique and prosocline ribs running over the subsutural shelf, with 1-2 strong sharp keels at the periphery and another at the base, and no columellar fold (Peñas & Rolán, 2017, p. 276). Although not mentioned by those authors, *Herewardia* species also have secondary spiral sculpture covering the entire shell surface.
Despite these similarites, *Rissoa obliquisculpta* cannot be placed in the genus *Herewardia*: firstly it lacks the peripheral keels above the peribasal keel, often composed by two elevated spirals. In *R. obliquisculpta* the periphery is formed by a rope-like peribasal cord, and any spiral sculpture above this is not elevated, and secondly the suture is not deeply and broadly canaliculate as it is in *Herewardia*. In *R. obliquisculpta* the suture is deeply impressed and the spire whorl somewhat gradate, giving the shell a biconic profile, whereas *Herewardia* species have a more pupoid profile, albeit angular.
In their work on the Pyramidelloidea of the Central and South Pacific, Peñas & Rolán (2017, p. 278-281) described two new *Herewardia* species that fit well within its generic concept. They described a third species from New Caledonia: "*Herewardia*" *osmagnum* Peñas & Rolán, 2017, which they placed in the genus provisionally, stating that it did not fit with the other known congeners. In-

deed, it differs from *Herewardia* in the two major points mentioned above, but is very similar to *R. obliquisculpta*. It differs from the Mediterranean Pliocene species in having a more elevated type C tending to B protoconch rather than type C and lacking further primary spiral cords above the peribasal cord. "*Herewardia*" *osmagnum* is therefore transferred to the genus *Lafolletteia* nov. gen. herein.

In Estepona all but one specimen of *Rissoa obliquisculpta* were found in the El Lobillo assemblage, which is shallow-water. Having said this, Ceregato & Tabanelli (2006, p. 34) suggested that Italian specimens might be associated with an epibathyal habitat. *Lafolletteia osmagnum* is a deep-water species (400-532 m depth; Peñas & Rolán, 2017, 2017, p. 282). It is possible that *Lafolletteia* has a relatively wide bathymetric range, but with only two species included it is difficult to conclude too much about its bathymetry or explain its disjunct distribution.

***Lafolletteia obliquisculpta* (Seguenza, 1880)**
Plate 59, figs 1-4

*1880	*Rissoa obliquisculpta* Seguenza, p. 116, pl. 11, fig. 46.
2006	*Chrysallida obliquisculpta* (Seguenza, 1879 [*sic*]) – Ceregato & Tabanelli, p. 33, figs 1, 2.
2010	*Chrysallida obliquisculpta* (Seguenza, 1879 [*sic*]) – Sosso & Dell'Angelo, p. 51, unnumbered fig. p. 66, bottom row right.
2018	*Chrysallida obliquisculpta* (Seguenza, G. 1879[*sic*]) – Brunetti & Cresti, p. 104, fig. 449.

Material and dimensions – Height 3.7 mm, width 2.5 mm. **VC**: NHMW 2019/0167/0604 (1). **EL**: NHMW 2019/0167/0576 (5), NHMW 2019/0167/0602-0603 (2).

Revised description – Shell small, solid, squat biconic shells, with depressed scalate spire. Protoconch type C. Teleoconch of 2.5 whorls, separated by deeply impressed, narrowly canaliculated suture. First whorl flat-sided, smooth, with one strong spiral cord placed mid-whorl on the second half of the whorl in some specimens, and one strong cord just above suture in all specimens, crossed by strongly prosocline, rounded axial ribs, extremely variable in number, widely separated to crowded. Rounded tubercles formed at sculptural intersections, strengthening abapically. Irregular secondary spirals and strongly prosocline growth lines cover entire teleoconch surface. Last whorl 73% of total height, anguled at strongly developed, rope-like, peribasal cord, placed at level of insertion of outer lip; base weakly convex, with axials persisting over base, imperforate. Aperture wide, 53% of total height, outer lip angled at termination of peribasal cord, strongly and broadly expanded abapically. Columella weakly excavated, smooth, devoid of fold; columellar callus strongly thickened, abapically, narrowed in parietal area.

Discussion – This extremely rare species is known in the Italian literature only from the original drawing and the specimen illustrated by Ceregato & Tabanelli (2006, figs 1, 2). Both of these show specimens with crowded ribs, similar to one of the Estepona specimens (Pl. 59, fig. 4). However, the number of ribs in the Estepona population seems to be extremely variable and specimens with

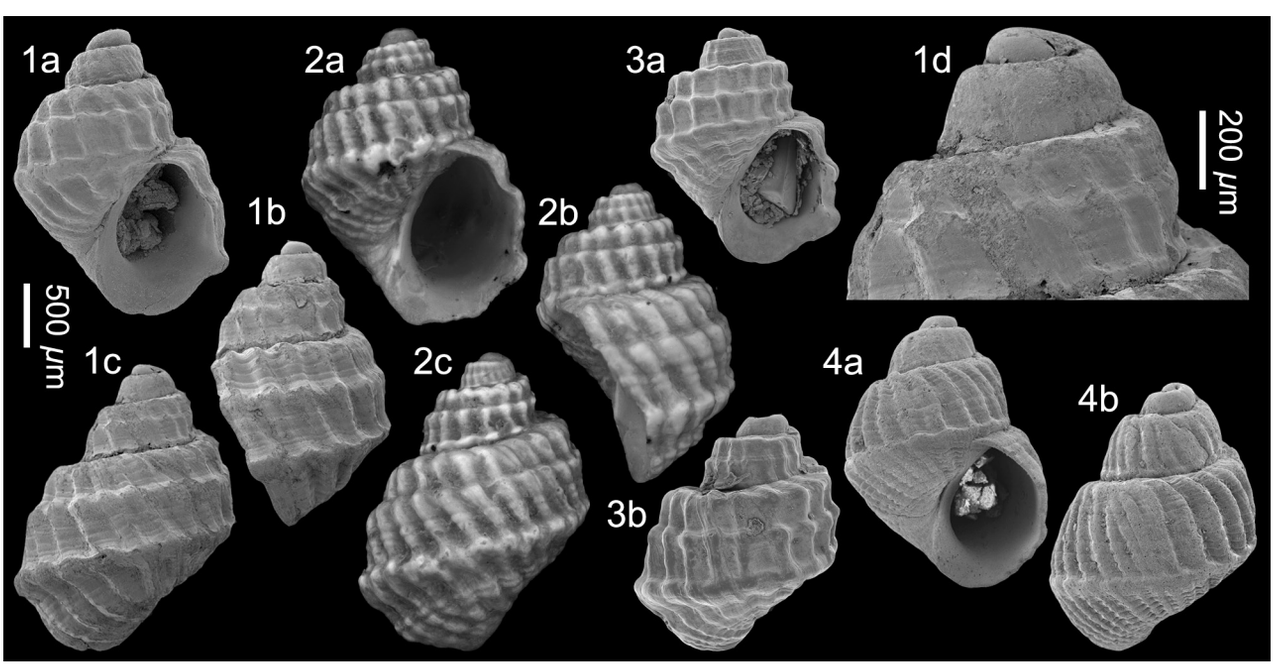

Plate 59. *Lafolletteia obliquisculpta* (Seguenza, 1880); 1. NHMW 2019/0167/0576, height 2.5 mm, width 1.8 mm, 1d, detail of protoconch; 2. NHMW 2019/0167/0602, height 3.7 mm, width 2.5 mm; 3. NHMW 2019/0167/0603, height 1.8 mm, width 1.5 mm; (1, 3 SEM images, 2, digital image). El Lobillo. 4. NHMW 2019/0167/0604, height 2.1 mm, width 1.6 mm (SEM image). Velerín carretera, Estepona, lower Piacenzian, upper Pliocene.

widely spaced ribs and a further strong spiral cord placed mid-whorl, resulting in a cancellate sculpture, occur (Pl. 59, figs 1, 3). One might be tempted to consider them separate species, however, intermediate specimens between these two forms are also present (Pl. 59, fig. 2). For further discussion see generic note above.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); Ceregato & Tabanelli, 2006; Sosso & Dell'Angelo, 2010).

Genus *Mulderia* nov. gen.

Type species – *Mulderia mulderi* nov. sp., Pliocene, Iberia.

Other species included – *Miralda robertsoni* Van Regteren Altena, 1975 (present-day, Suriname, western Atlantic), *Odostomia* cf. *robertsoni* (Van Regteren Altena, 1975) (*in* Díaz & Hegedus, 1994, p. 235, pl. 69, fig. 935) (present-day, Colombian Carribean), *Folinella spinosula* Micali, 1992, *Miralda mellianensis* Lozouet, 1998 (lower Miocene, Aquitanian, France), *Iolaea amazonica* Van Aartsen & Wesselingh, 2005 (Miocene, Pebas Formation, Peru), *Boonea* sp. B (in Redfern, 2013, p. 233, fig. 651; present-day, Bahamas, western Atlantic), *Iolaea miocaenica* Landau & LaFollette, 2015 (lower-middle Miocene, Cantaure Formation, Venezuela), *Ividella ligeriensis* Landau, Micali, Van Dingenen & Ceulemans, 2020 (upper Miocene, Tortonian, northwestern France), *Ividella tuberculata* Landau, Micali, Van Dingenen & Ceulemans, 2020 (upper Miocene, Tortonian, northwestern France).

Diagnosis – Small, medium-thickness shells, type B tending to C or more commonly type C protoconch, teleoconch of 3-4 convex whorls, with more or less developed subsutural ramp delimited by shoulder cord. Sculpture cancellate with spiral component predominant, narrow axial ribs that persist onto the base, small tubercles formed at sculptural intersections in some species. Last whorl moderately inflated, slightly angled at shoulder, base not clearly delimited, small umbilical chink. Aperture ovate, outer lip evenly convex, slightly expanded abapically. Columella weakly excavated, slightly thickened abapically; weak to moderately developed columellar fold.

Etymology – Named after Henk Mulder of Monster (Netherlands) who collected a large amount of the material for this work.

Discussion – Species included in this genus have been placed in *Miralda* A. Adams, 1863 (type species *Parthenia diadema* A. Adams, 1860, by subsequent designation, Verrill & Bush, 1900), but species in that genus have broader cords, some of which are coarsely beaded, especially the adapical cords. Axial sculpture is reduced to close-set growth lines that can be prominent, but not forming well defined ribs (see Peñas & Rolán, 2017 pp 293-321); *Boonea* Robertson, 1978 (type species *Jaminea seminuda* C.B. Adams, 1839, by original designation), which differs in including more robust species, usually more elongate, with coarsely beaded sculpture and are imperforate, or at most have a very narrow umbilical chink. Landau & LaFollette (2015, p. 20) suggested that *Miralda robertsoni* Van Regteren Altena, 1975 should be placed in the genus *Iolaea* A. Adams, 1867, but members of that genus are more telescopic in profile, taller-spired with a greater number of whorls, and have a relatively shorter last whorl. *Ividella* Dall & Bartsch, 1909 species (see above) are more robust, with elevated ribs, spiral sculpture formed by cords almost equal in strength to the ribs that overrun the ribs forming a strongly reticulated surface sculpture, and a base with some spiral cords, but no axials. We thank Patick LaFollette for bringing this group to our attention.
Mulderia nov gen. is therefore a thermophilic Atlantic genus represented on both sides of the Atlantic in the Miocene, but today restricted to Tropical West Atlantic.

***Mulderia mulderi* nov. sp.**
Plate 60, figs 1-2

2018 *Chrysallida* sp. – Brunetti & Cresti, p. 106, fig. 451.

Type material – Holotype NHMW 2019/0167/0154, height 2.3 mm, width 1.1 mm; paratype 1 NHMW 2019/0167/0155, height 2.6 mm, width 1.3 mm; paratype 2 NHMW 2019/0167/0156; paratype 3 NHMW 2019/0167/0157, height 2.4 mm, width 1.1 mm; paratype 4 NHMW 2019/0167/00472, height 2.4 mm, width 1.2 mm.

Other material – **VC**: NHMW 2019/0167/0158 (4). **VS**: NHMW 2019/0167/0817 (1).

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

Type stratum – lower Piacenzian, upper Pliocene.

Etymology – Named after Henk Mulder of Monster (Netherlands), keen amateur palaeontologist and friend of the first author, who collected a large amount of the material described herein. *Ividella* gender feminine.

Diagnosis – *Mulderia* species of small size, type C protoconch, 3.5 shouldered teleoconch whorls with well-developed subsutural ramp, cancellate sculpture consisting of 28-30 ribs and four cords on spire whorls, weak columellar fold, small umbilical chink.

Description – Shell small, medium-thickness. Protoconch type C, involute. Teleoconch of 3.5 whorls with relatively broad, weakly convex subsutural ramp, sharply delimited at shoulder cord, weakly convex below, separated by

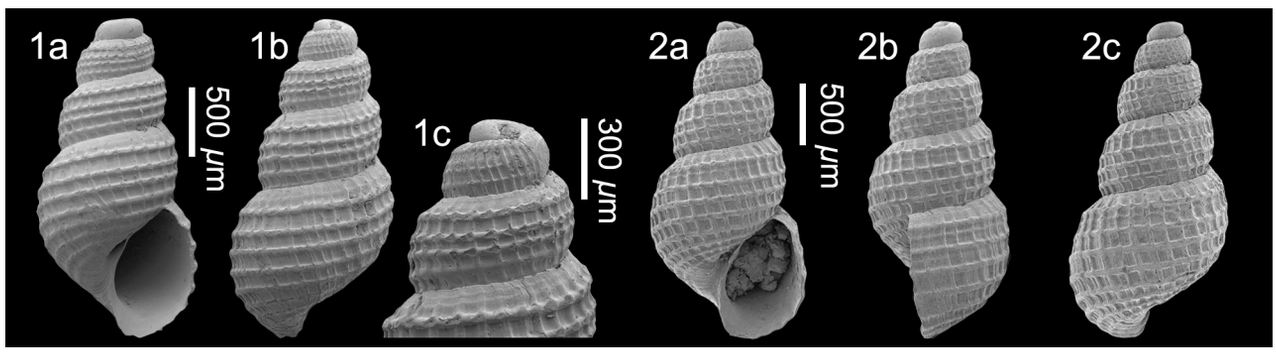

Plate 60. *Mulderia mulderi* nov. sp.; 1. **Holotype** NHMW 2019/0167/0154, height 2.3 mm, width 1.1 mm, 1c, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0155, height 2.6 mm, width 1.3 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

impressed linear suture. Sculpture cancellate with spiral component predominant, 28-30 narrow, prosocline axial ribs, weakening over subsutural ramp, overrun by elevated spirals; two weaker spirals on subsutural ramp; four strong spirals below shoulder. Small tubercles formed at sculptural intersections. Last whorl 64% of total height, slightly angled at shoulder, nine spiral cords below shoulder, base not clearly delimited, small umbilical chink. Aperture ovate, 40% of total height. Outer lip evenly convex, slightly expanded abapically. Columella weakly excavated, slightly thickened abapically; weak columellar fold within, not visible on apertural view.

Discussion – *Mulderia mulderi* nov. sp. differs from *Mulderia mellianensis* (Lozouet, 1998) from the lower Miocene, Aquitanian, France in being less slender, with stronger axial sculpture and four spirals from the earliest teleoconch whorl, whereas the French Miocene species only has one on the first whorl, four on the second whorl. *Boonea* sp. B (in Redfern, 2013, p. 233, fig. 651) from the present-day, Bahamas is extremely similar to *M. mulderi*, differing only in having more numerous cords over the base. *Mulderia robertsoni* (Van Regteren Altena, 1975) from present-day Suriname differs in having less convex whorls and only three cords on the spire whorls as opposed to four in *M. mulderi*; *Mulderia miocaenica* (Landau & LaFollette, 2015) from the lower-middle Miocene, Cantaure Formation, Venezuela also differs in having only three cords on the spire whorls. *Mulderia amazonica* (Van Aartsen & Wesselingh, 2005) from the Miocene, Pebas Formation of Peru differs in having more whorls in the fully adult state (although the profile of the paratype RGM.456801 is very similar to *M. mulderi*; see Van Aartsen & Wesselingh, 2005, p. 23, fig. 3) and in being the only member of the group withn a less intorted type B protoconch. *Mulderia tuberculata* (Landau, Micali, Van Dingenen & Ceulemans, 2020) from the upper Miocene, Tortonian of northwestern France is taller spired and differs in producing small tubercles at the sculptural intersections. *Mulderia ligeriensis* (Landau, Micali, Van Dingenen & Ceulemans, 2020), from the same assemblage as *M. tuberculata* is again taller with fewer cords.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0332); western Mediterranean, Estepona Basin, Spain (this paper).

Genus *Parthenina* Bucquoy, Dautzenberg & Dollfus, 1883

Type species – *Turbo interstinctus* J. Adams, 1797, by original designation, present-day, British Isles.

1827 *Jaminia* T. Brown, p. iv. Type species (by subsequent designation, Schander *et al*., 1999, p. 150): *Turbo interstinctus* J. Adams, 1797, *non* Risso, 1826 [Enidae], present day, British Isles.

1870 *Elodia* de Folin, p. 200. Type species (by subsequent monotypy): *Elodia hortensiae* de Nansouty *in* de Folin & Périer, 1872, present-day, France. Junior homonym of *Elodia* Robineau-Desvoidy, 1863 [Diptera].

1883 *Parthenina* Bucquoy, Dautzenberg & Dollfus, p. 158, 168. *Subgen. nov. pro Parthenia* Lowe, 1841, *non* Robineau-Desvoidy, 1830 [Diptera].

1886 *Elodiamea* de Folin *in* Hoyle, p. 94. Type species (by typification of replaced name): *Elodia hortensiae* de Nansouty *in* de Folin & Périer, 1872, present-day, France. *Nom. nov. pro Elodia* de Folin, 1870, *non Elodia* Robineau-Desvoidy, 1863 [Diptera].

1933 *Tiberia* (*Tiberiella*) Coen, p. 164. Type species (by monotypy): *Tiberia pretiosa* Coen, 1933, present-day, Mediterranean.

1958 *Egilina* (*Prestoniella*) Saurin, p. 65. Type species (by original designation): *Pyrgulina prestoni* Dautzenberg & H. Fischer, 1907, present-day, Vietnam.

1972b *Perparthenina* Nordsieck, p. 94. Type species (by original designation): *Chemnitzia terebellum* Philippi, 1844, present-day, Italy.

For discussion see Landau & LaFollette, (2015, p. 22).

***Parthenina brattstroemi* (Warén, 1991)**
Plate 61, figs 1-2

*1991	*Chrysallida brattstroemi*	Warén, p. 100, figs 32A-C, 33D.
1993	*Chrysallida brattstroemi*	Warén, 1991 – Micali *et al*., p. 153, fig. 7.
1996	*Chrysallida brattstroemi*	Warén, 1991 – Peñas *et al*., p. 14, figs 27-28.
2001	*Chrysallida brattstroemi*	Warén, 1991 – Cachia *et al*., p. 85, pl. 13, fig. 2.
2014	*Parthenina brattstroemi*	(Warén, 1991) – Giannuzzi-Savelli *et al*., p. 68, fig. 187, appendix p. 21, 69.
2014	*Chrysallida brattstroemi*	(Warén, 1991) [*sic*] – Høisæter, p. 22, fig. 22.

Material and dimensions – Maximum height 895 μm, width 565 μm. **VS**: NHMW 2019/0167/0699-0700 (2), NHMW 2019/0167/0701 (3).

Discussion – *Parthenina brattstroemi* (Warén, 1991) is characterised by its minute size, short, blunt, cylindrical shell profile, with convex whorls, relatively well-developed umbilical chink, and type B protoconch. Its sculpture of about twenty strong, orthocline, flexuous ribs and three cords on the abapical portion of the last whorl, which do not cross the axial ribs, is similar to the present-day Scandinavian *P. eximia* (Jeffreys, 1849) and *P. hoeisaeteri* (Warén, 1991), but those species are both larger, with a tall conical profile. *Parthenina intumescens* (Schander 1994) from Angola has a large and depressed type C protoconch, orthocline instead of prosocline ribs, a subcylindrical instead of pupoid outline, and the ribs extend only a short distance over the base. This is the oldest stratigraphic record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Micali *et al*., 1993). Present-day: Atlantic, Norway (Høisæter, 2014) to Mediterranean (Warén, 1991), western Mediterranean (Peñas *et al*., 1996; central Mediterranean (Micali *et al*., 1993; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

***Parthenina clathrata* (Jeffreys, 1848)**
Plate 62, figs 1-2

*1848	*Odostomia clathrata*	Jeffreys, p. 345.
1972b	*Chrysallida* (*Parthenina*) *clathrata*	(Jeffreys, 1848) – Nordsieck, p. 94, pl. PI, fig. 15.
1977	*Chrysallida clathrata*	(Jeffr.) – Van Aartsen, p. 51, 58, pl. 1, fig. 6.
1984	*Chrysallida clathrata*	(Jeffreys, 1848) – Chirli, p. 24, fig. 2.
1986	*Chrysallida clathrata*	(Jeffreys, 1848) – Fretter *et al*., p. 566, fig. 383.
1988	*Chrysallida clathrata*	(Jeffreys, 1848) – Graham, p. 554, fig. 238.
1992	*Chrysallida clathrata*	(Jeffreys, 1848) – Van der Linden & Eikenboom, p. 27, fig. 36.
1996	*Chrysallida clathrata*	(Jeffreys, 1848) – Peñas *et al*., p. 15, fig. 11.
1998	*Chrysallida clathrata*	(Jeffreys, 1848) – Peñas & Rolán, p. 49, figs 140-141.
2000	*Chrysallida* (*Parthenina*) *clathrata*	(Jeffreys, 1848) – Van Aartsen *et al*., p. 34, fig. 40.
2001	*Chrysallida clathrata*	(Jeffreys, 1848) – Cachia *et al*., p. 85, pl. 13, fig. 4.
2011	*Chrysallida clathrata*	(Jeffreys, 1848) – Chirli & Micali, p. 20, pl. 6, figs 1-5.
2011	*Chrysallida clathrata*	(Jeffreys, 1848) – Hernández *et al*., p. 247, figs 85I-L.
2011	*Chrysallida clathrata*	(Jeffreys, 1848) – Öztürk *et al*., p. 56, fig. 2.
2014	*Chrysallida clathrata*	(Jeffreys, 1848) – Giannuzzi-Savelli *et al*., p. 68, figs 188-190, appendix p. 22, 69.
2018	*Parthenina clathrata*	(Jeffreys, 1848) – Trigo *et al*., p. 361, fig. 7.
non 1874	*Chemnitzia clathrata*?	Jeffreys – Wood, p. 59, pl. 7, fig. 18.

Material and dimensions – Maximum height 3.1 mm, width 1.3 mm. **VC**: NHMW 2019/0167/0806 (2). **VS**: NHMW 2019/0167/0445-0446 (2), NHMW 2019/0167/0447 (3). **EL**: NHMW 2019/0167/0793 (16).

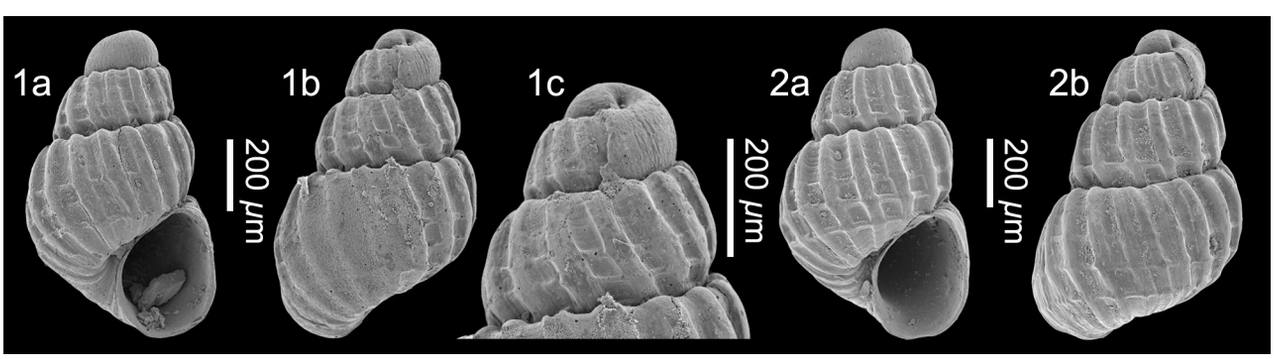

Plate 61. *Parthenina brattstroemi* (Warén, 1991); 1. NHMW 2019/0167/0699, height 855 μm, width 510 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0700, height 895 μm, width 565 μm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

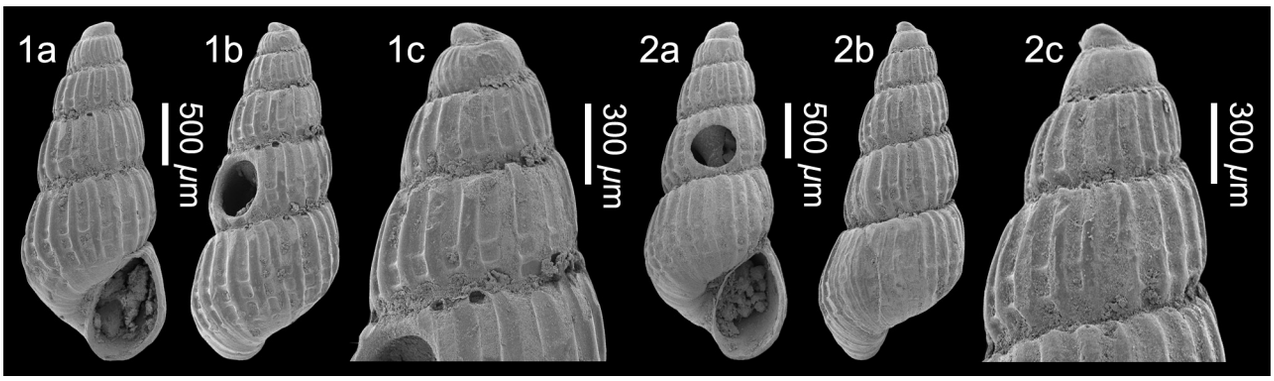

Plate 62. *Parthenina clathrata* (Jeffreys, 1848); 1. NHMW 2019/0167/0445, height 2.7 mm, width 1.1 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0446, height 3.1 mm, width 1.3 mm, 2c, detail of protoconch (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Parthenina clathrata* (Jeffreys, 1848) is characterised by its elongated, conical-cylidrical profile, rather elevated type B protoconch, teleoconch of up to seven weakly convex whorls, axial sculpture of 20-22 straight or slightly flexuous, orthocline to slightly prosocline ribs, separated by intervals broader than the ribs, with two narrow abapical cords visible in the interspaces. The last whorl is rounded, with the adapical cord placed close to mid-whorl and a third spiral cord delimiting the base, the ribs weaken over the base, narrow umbilical chink present, and a weak columellar fold. The fine secondary spiral threads present in the axial interspaces above the two abapical primary cords described by some authors (*e.g.*, Chirli & Micali, 2011, p. 20) are not evident in the Estepona specimens. They are also not described in the very detailed description given by Fretter *et al*. (1986, p. 566) and may not be present in all populations. Several authors have noted other small morphological differences between extant populations (Peñas & Rolán, 1998, p. 50; Van Aartsen *et al.,* 2000, p. 34). The Estepona specimens are relatively squat, not unlike that illustrated by Peñas & Rolán (1998, fig. 140) from Madeira and very similar to the specimen from Malta figured by Van Aartsen *et al*. (2000, fig. 40). The very tall specimen from the Italian Pliocene illustrated by Chirli & Micali (2011, pl. 6, figs 1-3) is an unusual form, but also in the present-day Mediterranean the species is highly variable (PM personal observation).
The shell from the lower Pliocene Coralline Crag of England figured by Wood (1874, pl. 7, fig. 18) as *Chemnitzia clathrata*? has regular cancellate sculpture covering the entire teleoconch and does not seem to be this species.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli, 1984; Crovato & Micali, 1992a; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Peñas & Rolán, 1998); central Mediterranean, Italy (Crovato & Micali, 1992a). Lower Pleistocene: central Mediterranean, Italy (Rindone & Vazzana, 1989). Present-day: Atlantic, southern British Isles (Nordsieck, 1972b; Fretter *et al*., 1986), northwestern Spain (Trigo *et al*., 2018), Madeira and Selvagens Islands (Segers *et al*., 2009), Canary Islands (Hernández *et al*., 2011), southwards to Mauritania (Peñas & Rolán, 1998), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011).

***Parthenina dantarti* (Peñas & Rolán, 2008)**
Plate 63, figs 1-3

*2008	*Chrysallida dantarti* Peñas & Rolán, *in* Peñas, Rolán & Ballesteros, p. 30, figs 35-38.
2014	*Parthenina dantarti* (Peñas & Rolán, 2008) – Giannuzzi-Savelli *et al*., p. 68, figs 191-192, appendix p. 22, 69.
2014	*Parthenina dantarti* (Peñas & Rolán, 2008) – Peñas *et al*., p. 111, figs 2A-D.

Material and dimensions – Maximum height 2.9 mm, width 1.0 mm. **VC**: NHMW 2019/0167/0698 (1). **VQ**: NHMW 2019/0167/0473 (1). **EL**: NHMW 2019/0167/0649-0650 (2).

Discussion – *Parthenina dantarti* (Peñas & Rolán, 2008) is characterised by its small size, short conico-cylindrical profile with a blunt apex, type C protoconch, teleoconch of up to four weakly convex to almost flat-sided whorls separated by a relatively superficial suture, axial sculpture of 14-16 more or less sinuous, weakly opisthocline, broad, rounded ribs, broader than their interspaces, two abapically placed narrow cords seen in the axial interspaces on the spire whorls. The last whorl is rounded, the axials stop relatively abruptly at the periphery, 3-4 narrow abapical spirals; the base is smooth, with a narrow umbilical chink, and a moderately developed fold within the aperture visible only when the aperture is rotated. One specimen from Estepona (Pl. 63, fig. 1) is particularly similar to the shell from Palermo, Italy, illustrated by Giannuzzi-Savelli *et al*. (2014, fig. 191).
In outline and having two spiral cords on spire whorls, this species may be confused with *P. indistincta* (Mon-

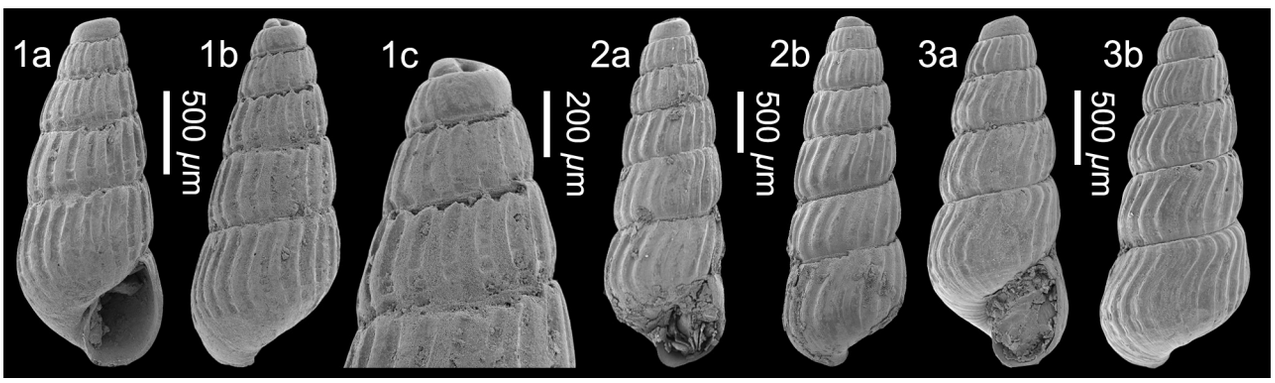

Plate 63. *Parthenina dantarti* (Peñas & Rolán, 2008); 1. NHMW 2019/0167/0473, height 2.1 mm, width 865 µm, 1c, detail of protoconch. Velerín quarry, Velerín. 2. NHMW 2019/0167/0649, height 2.9 mm, width 1.0 mm; 3. NHMW 2019/0167/0650, height 2.4 mm, width 950 µm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

tagu, 1808), from which it differs in having a columellar fold, absent in *P. indistincta*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic West Africa, Senegal and Mauritania (Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 2008), central Mediterranean (Giannuzzi-Savelli *et al*., 2014).

***Parthenina decussata* (Montagu, 1803)**
Plate 64, figs 1-2

*1803	*Turbo decussatus* Montagu, p. 322, pl. 12, fig. 4.
1882	*Odostomia decussata* Montagu – Bucquoy *et al*., p. 175, pl. 19, figs 18, 19.
1914	*Parthenina semiornata* Cerulli-Irelli, p. 262 [436], pl. 23 [55], figs 1-3.
1969	*Pyrgulina* (*Parthenina*) *semiornata* Cerulli-Irelli – Fekih, p. 23, pl. 3, fig. 14.
1972b	*Chrysallida* (*Pyrgulina*) *decussata* – Nordsieck, p. 98, pl. PII, fig. 8.
1977	*Chrysallida decussata* (Montagu) – Van Aartsen, p. 54, 58, pl. 2, fig. 10.
1986	*Chrysallida decussata* (Montagu, 1803) – Fretter *et al*., p. 567, figs 384-385
1988	*Chrysallida decussata* (Montagu, 1803) – Graham, p. 556, fig. 239.
1992	*Chrysallida decussata* (Montagu, 1803) – Van der Linden & Eikenboom, p. 38, fig. 50.
1996	*Chrysallida decussata* (Montagu, 1803) – Peñas *et al*., p. 15, figs 19-20.
2001	*Chrysallida decussata* (Montagu, 1803) – Cachia *et al*., p. 86, pl. 13, fig. 5.
2011	*Chrysallida decussata* (Montagu, 1803) – Öztürk *et al*., p. 56, fig. 3.
2014	*Parthenina decussata* (Montagu, 1803) – Giannuzzi-Savelli *et al*., p. 70, fig. 193, appendix p. 22, 70.
2018	*Parthenina decussata* (Montagu, 1803) – Ceulemans *et al*., p. 130, pl. 8, fig. 3.
2018	*Parthenina decussata* (Montagu, 1803) – Trigo *et al*., p. 361, fig. 8.

Material and dimensions – Maximum height 2.4 mm, width 1.1 mm. **CO**: NHMW 2019/0167/0468 (1), NHMW 2019/0167/0469 (3). **VA**: NHMW 2019/0167/0289 (1), NHMW 2019/0167/0290 (1). **EL**: NHMW 2019/0167/0655 (37).

Discussion – *Parthenina decussata* (Montagu, 1803) is characterised by its ovoid-conical shaped profile, protoconch type B tending to C, teleoconch of 3-4 weakly

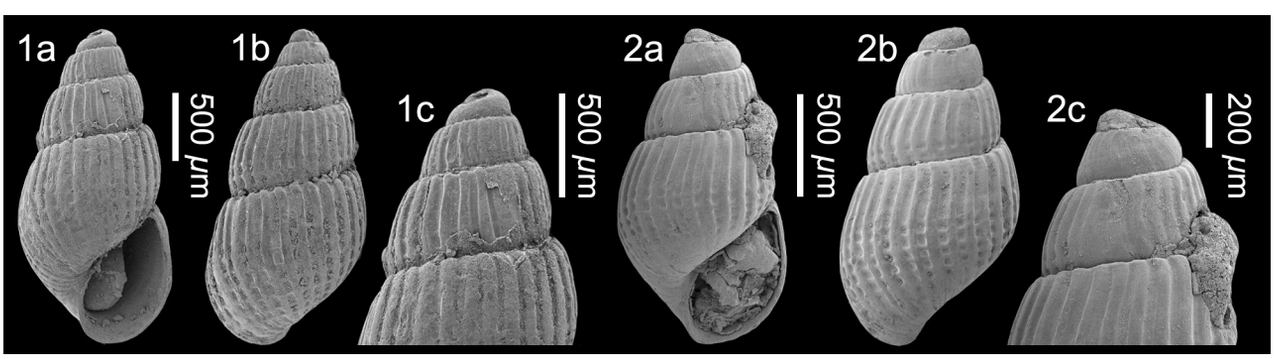

Plate 64. *Parthenina decussata* (Montagu, 1803); 1. NHMW 2019/0167/0289, height 2.4 mm, width 1.1 mm, 1c, detail or protoconch. Velerín antenna. 2. NHMW 2019/0167/0468, height 1.7 mm, width 895 µm, 2c, detail or protoconch (SEM images), Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

convex whorls separated by deeply impressed suture, broad, flat-topped ribs, 20-25 on the penultimate whorl, and weaker cords restricted to the abapical half of the whorls, visible only in the interspaces, 4-6 on the penultimate whorl, 8-13 on the last whorl, narrow umbilical chink, and the columellar fold is very weak. To our knowledge, this species has only been recorded as fossil by Crovato & Micali (1992a) from the Pliocene of Italy. *Parthenina semiornata* Cerulli-Irelli, 1914 from the lower Pleistocene of Italy is considered a junior subjective synonym herein.

Present-day Mediterranean specimens are characterised by a smooth first teleoconch whorl (see Peñas *et al*., 1996, fig. 19; Van Aartsen *et al*., 2000, p. 35, fig. 43), whereas fossil specimens do not usually show this character (Pl 64, fig 1; Ceulemans *et al*., 2018, pl. 8, fig. 3). In one of the Estepona specimens the first whorl is almost smooth (Pl. 64, fig. 2). Fretter *et al*. (1986, p. 567) noted that "*The first postlarval whorl is sometimes apparently smooth, perhaps from wear, sometimes has small costae*". One specimen from the Italian Pliocene Tuscany also has a smooth initial whorl (PM, personal observation). The loss of sculpture on the first whorl is, therefore, a trend from Pliocene to Recent times and does not warrant taxonomic separation. *Parthenina semiornata* Cerulli-Irelli, 1914, described from lower Pleistocene of Italy is herein considered a synonym of *P. decussata*. *Parthenina decussata* differs from *P. juliae* in having a more inflated profile, and the spiral sculpture extending over the base.

Distribution – Lower Pliocene: Atlantic, NW France (Ceulemans *et al*., 2018); central Mediterranean, Italy (Crovato & Micali, 1992a), Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Crovato & Micali, 1992a). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914). Present-day: Atlantic Shetland Islands, British Isles (Nordsieck, 1972b; Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), southwards to western Mediterranean (Bucquoy *et al*., 1882; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2011).

***Parthenina dollfusi* (Kobelt, 1903)**
Plate 65, figs 1-2

*1903	*Parthenia dollfusi* Kobelt, p. 120, pl. 70, figs 15, 16 [*nom. nov. pro Parthenina monozona* Brusina *sensu* Bucquoy *et al*., 1882; *non Parthenina monozona* (Brusina, 1869)] (*non Pyrgulina (Parthenina) Dollfusi* Cossmann, 1921 = *Pathenina pacaudi nov. nom*.).
1972b	*Chrysallida colungiana* Nordsieck, p. 94, pl. PI, fig. 14. Unnecessary replacement name for *Chrysallida dollfusi* Kobelt, 1887 (*nomen nudum*) *non* Cossmann, 1921.
1977	*Chrysallida colungiana* Nordsieck – Van Aartsen, p. 55, 57, pl. 4, fig. 24.
1992	*Chrysallida colungiana* Nordsieck, 1972 – Van der Linden & Eikenboom, p. 29, fig. 37.
1996	*Chrysallida dollfusi* (Kobelt, 1903) – Peñas *et al*., p. 16, fig. 29.
1998	*Chrysallida dollfusi* (Kobelt, 1903) – Peñas & Rolán, p. 41, figs 116, 117.
2001	*Chrysallida dollfusi* (Kobelt, 1903) – Cachia *et al*., p. 86, pl. 13, fig. 7.
2011	*Chrysallida dollfusi* (Kobelt, 1903) – Öztürk *et al*., p. 58, fig. 4.
2014	*Parthenina dollfusi* (Kobelt, 1903) – Giannuzzi-Savelli *et al*., p. 70, figs 194-195, appendix p. 22, 70.
2018	*Parthenina dollfusi* (Kobelt, 1903) – Trigo *et al*., p. 361, fig. 9.

Material and dimensions – Maximum height 2.0 mm, width 1.0 mm. **EL**: NHMW 2019/0167/0787 (1), NHMW 2019/0167/0789-0790 (1).

Discussion – *Parthenina dollfusi* (Kobelt, 1903) is characterised by its very small, solid, conical pupoid shell with a truncated apex, type C protoconch, teleoconch of up to four weakly convex whorls separated by a deep narrowly canaliculated suture, sculpture of numerous, close-set, orthocline axial ribs, 24-25 on the last whorl, sinuous on the last whorl, and two narrow spiral cords on the penultimate whorl and three at the periphery of the last whorl, small umbilical chink and columellar fold weak.

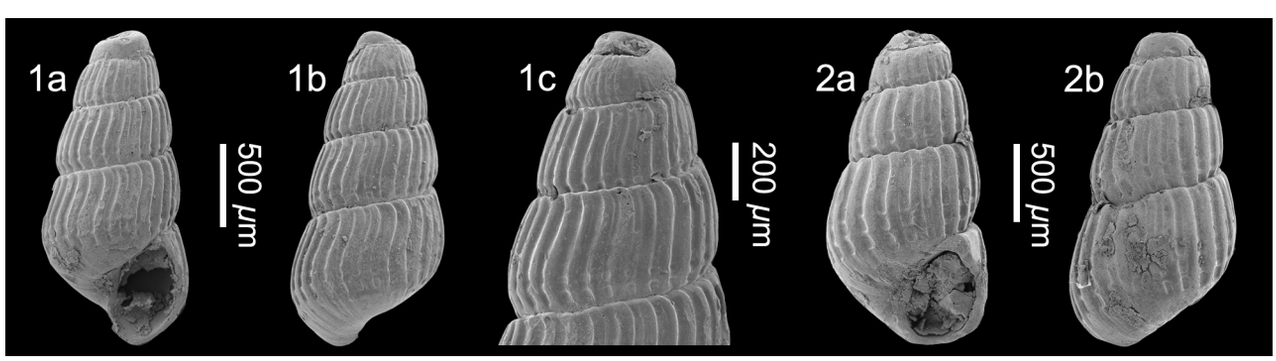

Plate 65. *Parthenina dollfusi* (Kobelt, 1903); 1. NHMW 2019/0167/0789, height 1.9 mm, width 875 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0790, height 2.0 mm, width 1.0 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

It differs from other species with three spiral cords at the periphery of the last whorl [*P. clathrata* (Jeffreys, 1848), *P. connexa* (Dautzenberg, 1912), *P. intumescens* (Schander, 1994)] in having a broader and more solid shell, narrowly canaliculated suture, more numerous axial ribs and weak columellar fold.

We note that Cossmann (1921, p. 258) described a species from the middle Miocene Langhian of the Loire Basin as *Pyrgulina (Parthenina) dollfusi*, which is a junior homonym of Kobelt's name. The French Miocene species was not illustrated, but the short description **"***une espèce plus treillissée que* Turbo spiralis *Montagu* ..."(Cossmann, 1921, p. 258) validates the name. We have great pleasure in renaming Cossmann's species *Parthenina pacaudi* nov. nom. after Jean Michel Pacaud of the Muséum national d'Histoire naturelle (Paris) who has retrieved the syntype (MNHN.F.J17569) from Pontlevoy (Loir-et-Cher).

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Present-day: Atlantic, Bay of Biscay (Trigo *et al*., 2018) and Lusitanian coast (Nordsieck, 1972b; Van der Linden & Eikenboom, 1992), West Africa, Canary Islands, Angola (Peñas & Rolán, 1998), into western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2011).

***Parthenina emaciata* (Brusina, 1866)**
Plate 66, figs 1-2

1865 *Turbonilla pygmaea* Brusina, p. 22 (*non* d'Orbigny, 1852).
*1866 *Turbonilla emaciata* Brusina, p. 69 [*nom. nov. pro T. pygmaea* Brusina, 1865, *non Turbonilla pygmaea* (Grateloup, 1838), considered secondary homonym].
1868 *Turbonilla ambigua* Weinkauff, p. 216.
1972b *Chrysallida* (*Perparthenina*) *emaciata* form *minor* Nordsieck, p. 97.
1977 *Chrysallida emaciata* (Br.) – Van Aartsen, p. 56, fig. 17.
1992 *Chrysallida emaciata* (Brusina, 1866) – Van der Linden & Eikenboom, p. 13, fig. 21.
1996 *Chrysallida* (*Perparthenina*) *emaciata* (Brusina, 1866) – Van Aartsen & Menkhorst, p. 49, fig. 8.
1996 *Chrysallida emaciata* (Brusina, 1866) – Peñas *et al*., p. 16, figs 36-37.
1998 *Chrysallida emaciata* (Brusina, 1866) – Peñas & Rolán, p. 44, figs 127-128.
1998 *Chrysallida emaciata* (Brusina, 1866) – Wilke & Van Aartsen, p. 9, pl. 1, fig. 1a-c.
2001 *Chrysallida emaciata* (Brusina, 1866) – Cachia *et al*., p. 86, pl. 13, fig. 8.
2011 *Chrysallida emaciata* (Brusina, 1866) – Öztürk *et al*., p. 58, fig 5A-C.
2013 *Chrysallida emaciata* (Brusina, 1866) – Landau *et al*., p. 312, pl. 75, fig. 5.
2014 *Parthenina emaciata* (Brusina, 1866) – Giannuzzi-Savelli *et al*., p. 64, fig. 154, appendix page 19, 66.
2020 *Parthenina emaciata* (Brusina, 1866) – Landau *et al*., p. 307, pl. 33, fig. 1.

Material and dimensions – Maximum height 2.5 mm, width 885 μm. **CO**: NHMW 2019/0167/0720 (1). **EL**: NHMW 2019/0167/0794-0795 (2), NHMW 2019/0167/0796 (4).

Discussion – *Parthenina emaciata* (Brusina, 1866) is characterised by its slender cylindrical shell with a blunt apex, type B tending to C protoconch, teleoconch of 3-4 whorls separated by a broad V-shaped suture. Sculpture consists of narrow, prosocline, very slightly arched axial ribs, 17 on penultimate whorl, separated by interspaces about three times wider than the ribs. Spire whorls bear one spiral cord, equal in strength to the ribs, placed at one-quarter whorl height, with a second cord appearing at the abapical suture near the end of the penultimate whorl. The entire surface is covered in fine irregular spiral microsculpture. This is only seen in fresh pecimens and is not preserved in the Estepona material. The last whorl has two spiral cords, the lower cord delimiting base, axial ribs are subobsolete over base, and a small

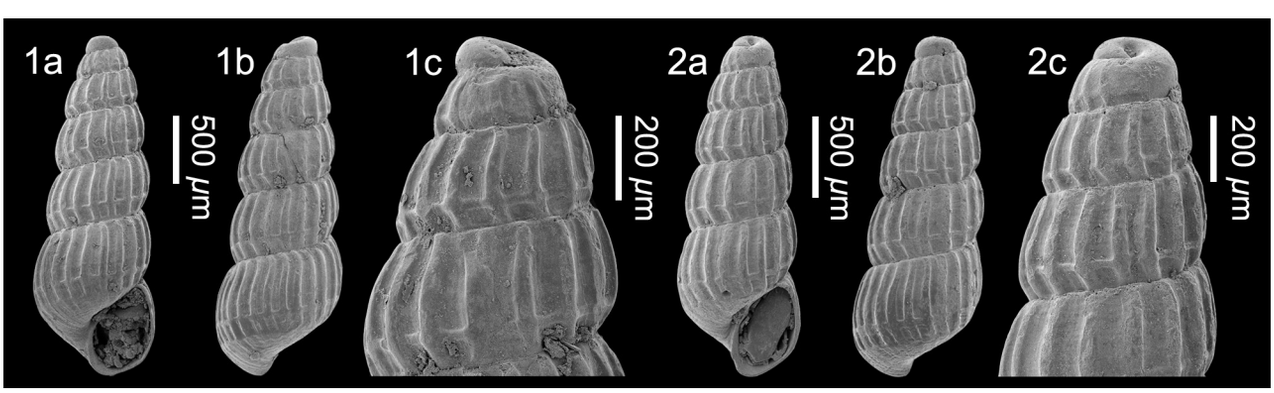

Plate 66. *Parthenina emaciata* (Brusina, 1866); 1. NHMW 2019/0167/0794, height 2.5 mm, width 885 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0795, height 2.1 mm, width 765 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

umbilical chink is present. The aperture is small, ovate, and the columella bears a small fold mid-height.
Several extant European and West African Atlantic congeners, such as *P. interstincta* (J. Adams, 1797) and *P. pyttelilla* (Schander, 1994), are sculptured by widely spaced axial ribs and one abapical spiral cord on the spire whorls, two on the last whorls, but neither of these species have such convex whorls nor any secondary spiral sculpture. *Parthenina monozona* (Brusina, 1869) [*Pyrgulina intermixta* Monterosato, 1884 is a synonym] from the Pliocene to present-day Mediterranean has similar sculpture, but the axials are broader and orthocline to weakly opisthocline, and the suture is deeper.

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene (Tortonian): NW France (Landau *et al*., 2020). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, south coast of Portugal (Van der Linden & Eikenboom, 1992), Canary Islands, Angola (Peñas & Rolán, 1998), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2011), Black Sea (Wilke & Van Aartsen, 1998).

***Parthenina feldi* (Van Aartsen, Gittenberger & Goud, 2000)**
Plate 67, figs 1-2

*2000	*Chrysallida* (*Parthenina*) *feldi*	Van Aartsen, Gittenberger & Goud, p. 35, fig. 44.
2008	*Chrysallida feldi*	Van Aartsen, Gittenberger & Goud, 2000 – Chirli & Micali, p. 40, figs 1F-H.
2011	*Chrysallida feldi*	Van Aartsen, Gittenberger & Goud, 2000 – Chirli & Micali, p. 26, pl. 8, figs 6-10.
2011	*Parthenina feldi*	(Van Aartsen, Gittenberger & Goud, 2000) – Lygre *et al*., p. 478, figs 1A-B.

Material and dimensions – Maximum height 1.5 mm, width 710 μm. **EL**: NHMW 2019/0167/0617-0618 (2), NHMW 2019/0167/0619 (1).

Discussion – *Parthenina feldi* (Van Aartsen, Gittenberger & Goud, 2000) is characterised by its very small subcylindrical shell, type C protoconch, teleoconch of 3-3.5 convex whorls, sculptured by 25-30 narrow, inverted S-shape ribs, slightly narrower than their interspaces that persist weakly onto the base, crossed by four narrow spirals placed on the abapical portion of the spire whorls that on the last whorl do not continue over the base. The last whorl is rounded at the base, umbilicus reduced to very small chink, aperture pyriform, with thin columellar callus, and no columellar fold. The Estepona specimens are very similar in both profile and sculpture to those illustrated from the Pliocene of Italy (Chirli & Micali, 2008, 2011).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2008, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0334); western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Cape Verde Islands and Senegal (Van Aartsen *et al*., 2000) to Congo (Lygre *et al*., 2011).

***Parthenina indistincta* (Montagu, 1808)**
Plate 68, figs 1-2

*1808	*Turbo indistinctus*	Montagu, p. 129.
1914	*Parthenina indistincta*	Mtg. – Cerulli-Irelli, p. 261 [435], pl. 22 [54], figs 72-74.
1914	*Parthenina indistincta* var. *transiens*	Cerulli-Irelli, p. 262 [436], pl. 22 [54], figs 75, 76.
1964	*Chrysallida* (*Pyrgulina*) *indistincta*	(Montagu, 1808) – Van Regteren Altena *et al*., p. 3, pl. 19, fig. 185.
1969	*Pyrgulina* (*Parthenina*) *indistincta* var. *transiens*	Ceru. Irel. – Fekih, p. 20, pl. 3, fig. 5.
1972b	*Chrysallida* (*Perparthenina*) *indistincta*	– Nordsieck, p. 95, pl. PI, fig. 19.
1977	*Chrysallida indistincta*	(Mont.) – Van Aartsen, p. 55, 58, pl. 2, fig. 14.
1986	*Chrysallida indistincta*	(Montagu, 1808) – Fretter *et al*., p. 564, figs 381, 382.
1988	*Chrysallida indistincta*	(Montagu, 1808) – Graham,

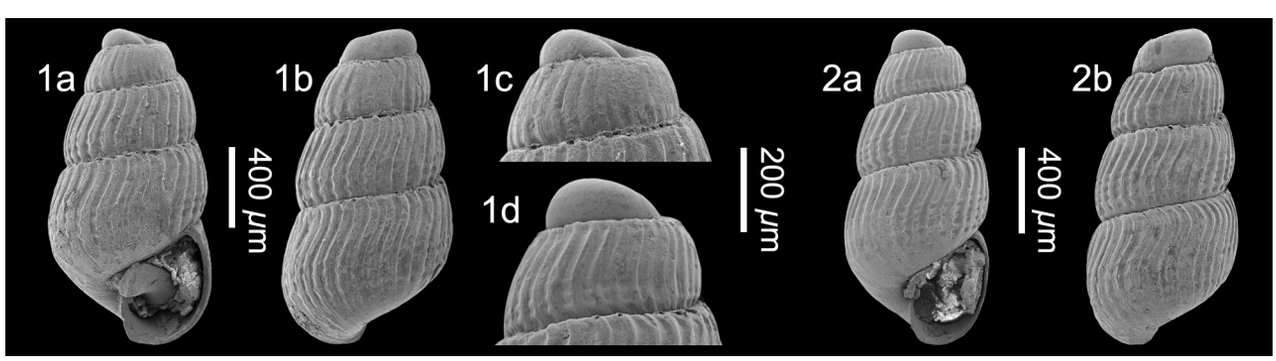

Plate 67. *Parthenina feldi* (Van Aartsen, Gittenberger & Goud, 2000); 1. NHMW 2019/0167/0617, height 1.4 mm, width 740 μm, 1c, d, detail of protoconch; 2. NHMW 2019/0167/0618, height 1.5 mm, width 710 μm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

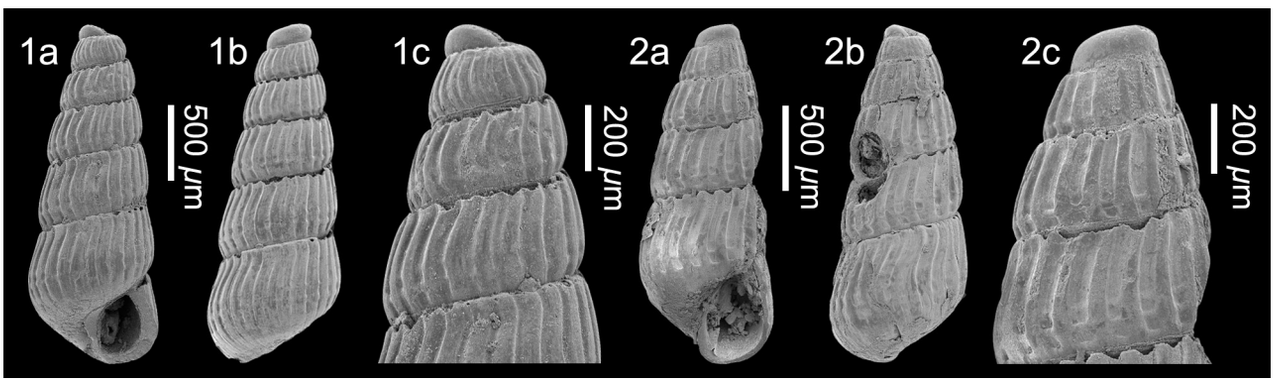

Plate 68. *Parthenina indistincta* (Montagu, 1808); 1. NHMW 2019/0167/0449, height 2.2 mm, width 815 μm, 1c, detail of protoconch. Velerín conglomerates. 2. NHMW 2019/0167/0448, height 1.8 mm, width 750 μm, 2c, detail of protoconch (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

p. 552, fig. 237.

1992 *Chrysallida indistincta* (Montagu, 1808) – Cavallo & Repetto, p. 152, fig. 425.

1992 *Chrysallida indistincta* (Montagu, 1808) – Van der Linden & Eikenboom, p. 31, figs. 11, 12, 43-45.

1993 *Chrysallida indistincta* (Montagu, 1808) – Micali *et al*., p. 150, fig. 5.

1993 *Chrysallida indistincta* (Montagu, 1808) – Marquet, p. 94, pl. 4, figs 7, 8.

1997 *Chrysallida indistincta* (Montagu, 1808) – Marquet, p. 105.

1998 *Chrysallida indistincta* (Montagu, 1808) – Marquet, p. 190, fig. 162.

1998 *Chrysallida indistincta* (Montagu) – Ferrero *et al*., p. 49, 52, pl. 2, fig. 1.

2001 *Chrysallida* cf. *indistincta* (Montagu, 1808) – Cachia *et al*., p. 87, pl. 13, fig. 10.

2011 *Chrysallida indistincta* (Montagu, 1808) – Chirli & Micali, p. 33, pl. 10, figs 11-15 (*cum syn*.).

2011 *Chrysallida indistincta* (Montagu, 1808) – Öztürk *et al*., p. 64, fig 10A-D.

2011 *Chrysallida indistincta* (Montagu, 1808) – Hernández *et al*., p. 249, figs 86G-I.

2014 *Parthenina indistincta* (Montagu, 1808) – Giannuzzi-Savelli *et al*., p. 70, figs 197, 198, appendix p. 22, 70.

2014 *Parthenina indistincta* (Montagu, 1808) – Høisæter, p. 15, fig. 5.

2018 *Parthenina indistincta* (Montagu, 1808) – Ceulemans *et al*., p. 131, pl. 8, fig. 4.

2018 *Parthenina indistincta* (Montagu, 1808) – Trigo *et al*., p. 361, fig. 10.

2020 *Parthenina indistincta* (Montagu, 1808) – Landau *et al*., p. 308, pl. 34, fig. 1.

2020 *Parthenina indistincta* (Montagu, 1808) – Raven, p. 43, fig. 59.

Material and dimensions – Maximum height 2.2 mm, width 815 μm. **CO**: NHMW 2019/0167/0449 (1), NHMW 2019/0167/0718 (1). **VS**: NHMW 2019/0167/0448 (1). **EL**: 2019/0167/0634 (9).

Discussion – *Parthenina indistincta* (Montagu, 1808) is characterised by its slender cylindrical to slightly conical shell with a blunt apex, type C protoconch, teleoconch composed of 4-7 flat sided to slightly convex whorls that are slightly inflated below mid-whorl and taper inwards abapically to the oblique suture, and sculpture of orthocline ribs, straight on early whorls, sinuous on later whorls and narrow spirals; 2-3 on early whorls, 3-4 on penultimate, 4-5 on last whorl. The umbilicus is hardly developed and columellar fold absent. For comparison with related species we refer to Van der Linden & Eikenboom (1992, p. 33) although we note that *P. flexuosa* (Monterosato, 1874) and *P. palazzii* (Micali, 1984) are not synonyms as suggested by those authors (see Micali *et al*., 1993; Lygre *et al*., 2011).

Distribution – Upper Miocene (Tortonian): Atlantic, NW France (Landau *et al*., 2020). Lower Pliocene: Atlantic, northwestern France (Ceulemans *et al*., 2018); western Mediterranean, Tunisia (Fekih, 1969); central Mediterranean, Italy (Forli *et al*., 1999; Crovato & Micali, 1992a; Chirli & Micali, 2011). Upper Pliocene: North Sea Basin, Oorderen Sands, Belgium (Marquet, 1993, 1997, 1998); Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0335); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Cavallo & Repetto, 1992; Crovato & Micali, 1992a; Ferrero *et al*., 1998). Pliocene (indeterminate): North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Crovato & Micali, 1992a). Upper Pleistocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Present-day: Atlantic, Norway (Høisæter, 2014), North Sea (Raven, 2020), British Isles (Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), to Gibraltar (Nordsieck, 1972b), Madeira and Selvagens Islands (Segers *et al*., 2009), Canary Islands (Hernández *et al*., 2011), to western Mediterranean (Fretter *et al*., 1986), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi- Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011).

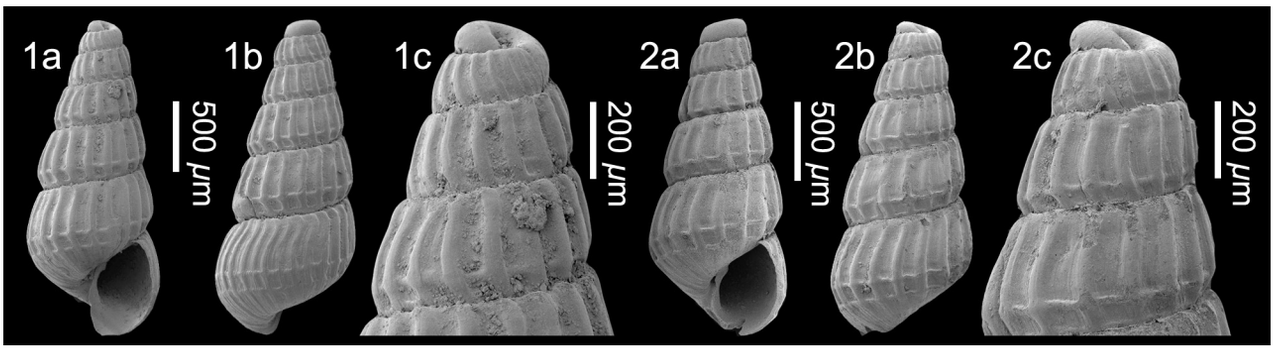

Plate 69. *Parthenina interstincta* (J. Adams, 1797); 1. NHMW 2019/0167/0127, height 2.2 mm, width 885 µm, 1c, detail of protoconch; 2. NHMW 2019/0167/0128, height 2.0 mm, width 875 µm, 2c, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Parthenina interstincta* (J. Adams, 1797)**
Plate 69, figs 1-2

*1797	*Turbo interstinctus* J. Adams, p. 66, pl. 13, figs 23, 24.
1827	*Jaminia obtusa* Brown pl. 50, figs 27, 28.
1872	*Elodia hortensiae* de Nansouty *in* de Folin & Périer, p. 48, pl. 2, fig. 2.
1882	*Odostomia interstincta* Montagu – Bucquoy *et al*., p. 169, pl. 20, fig. 7.
1882	*Odostomia jeffreysi* var. *flexicostata* Bucquoy, Dautzenberg & Dollfus, p. 171, pl. 20, fig. 10.
1892a	*Pyrgulina interstincta* var. *subappennina* Sacco, p. 66, pl. 1, fig. 108.
1914	*Parthenina interstincta* Mtg. [*sic*] – Cerulli-Irelli, p. 260 [434], pl. 22 [54], figs 61-66.
1914	*Parthenina interstincta* var. *bicingulata* Brugn. – Cerulli-Irelli, p. 260 [434], pl. 22 [54], figs 67, 68 [*non Parthenina bicingulata* (Brugnone, 1862a)]
1914	*Parthenina interstincta* var. *tristriata* Cerulli-Irelli, p. 260 [434], pl. 22 [54], fig. 69.
1914	*Parthenina interstincta* var. *quadristriata* Cerulli-Irelli, p. 260 [434], pl. 22 [54], fig. 70.
1921	*Pyrgulina* (*Parthenina*) *interstincta* (Montagu [*sic*]) – Cossmann, p. 258, pl. 6, figs 28-31.
1923	*Pyrgulina interstincta* Mont. – Friedberg, p. 455, pl. 28, fig. 7.
1933	*Tiberia* (*Tiberiella*) *pretiosa* Coen, p. 51, 164, pl. 4, fig. 32.
1955	*Chrysallida interstincta* (Montagu) – Moroni, p. 102, pl. 4, fig. 22.
1969	*Pyrgulina* (*Parthenina*) *interstincta* (Montagu.) – Fekih, p. 18, pl. 2, fig. 12.
1971	*Chrysallida* (*Parthenina*) *interstincta* (Montagu) – Greco, p. 288, pl. 4, figs 10-11.
1972b	*Chrysallida* (*Parthenina*) *interstincta* (Montagu, 1803) – Nordsieck, p. 92, pl. PI, fig. 8.
1972b	*Chrysallida farolita* Nordsieck, p. 96, PI, fig. 22.
1974	*Chrysallida* (*Parthenina*) *interstincta* (Montagu, 1803) – Malatesta, p. 442, pl. 32, fig. 14.
1977	*Chrysallida obtusa* (Brown) – Van Aartsen, p. 57, 58, pl. 3, fig. 22.
1984	*Chrysallida obtusa* (Brown, 1827) – Chirli, p. 26, fig. 6.
1984	*Pyrgulina interstincta* var. *subappennina* Sacco, 1892 – Ferrero Mortara *et al*., p. 78, pl. 11, fig. 10.
1988	*Chrysallida obtusa* (Brown, 1827) – Graham, p. 546, fig. 234.
1992	*Chrysallida obtusa* (Brown, 1827) – Van der Linden & Eikenboom, p. 23, figs 8, 9, 30-32.
1996	*Chrysallida interstincta* (J. Adams, 1797) – Peñas *et al*., p. 22, figs 43-47, 51.
1998	*Chrysallida obtusa* (T. Brown, 1827) – Wilke & Van Aartsen, p. 10, pl. 4, fig. 19a-c.
2000	*Chrysallida* (*Parthenina*) *obtusa* (Brown, 1827) – Van Aartsen *et al*., p. 28, fig. 33.
2001	*Chrysallida interstincta* (J. Adams, 1797) – Cachia *et al*., p. 88, pl. 14, fig. 1.
2003	*Chrysallida* (*Parthenina*) *interstincta* (Adams) – İslamoğlu & Taner, p. 45, pl. 2, fig. 14.
2005	*Chrysallida interstincta* (J. Adams, 1797) – Rolán, p. 191, fig. 885.
2004	*Chrysallida interstincta* (J. Adams, 1797) – Solustri & Micali, p. 64, fig. 5a.
2011	*Chrysallida interstincta* (Adams, J., 1797) – Chirli & Micali, p. 35, pl. 11, figs 6-10 (*cum syn*.).
2011	*Chrysallida interstincta* (Adams, J., 1797) – Chirli & Linse, p. 196, pl. 74, fig. 1.
2011	*Chrysallida interstincta* (J. Adams, 1797) – Hernández *et al*., p. 250, figs 86J-L.
2011	*Chrysallida obtusa* (Brown, 1827) – Öztürk *et al*., p. 71, fig. 17.
2013	*Chrysallida obtusa* (Brown, 1827) – Landau *et al*., p. 314, pl. 75, fig. 10.
2014	*Parthenina interstincta* (J. Adams, 1797) – Peñas *et al*., p. 112, fig. 2E.
2014	*Parthenina interstincta* (J. Adams, 1797) – Høisæter, p. 16, figs 6-11.
2014	*Parthenina interstincta* (J. Adams, 1797) – Giannuzzi-Savelli *et al*., p. 64, figs 158-162, appendix p. 19, 67.
2018	*Parthenina interstincta* (Adams J., 1797) – Brunetti & Cresti, p. 106, fig. 453.
2020	*Parthenina interstincta* (J. Adams, 1797) – Landau *et al*., p. 309, pl. 35, figs 1, 2.

non 1920 *Pyrgulina interstincta* (Montagu [*sic*]) – Harmer, p. 576, pl. 49, fig. 48.
non 1963 *Chrysallida* (*Parthenina*) *interstincta* (Montagu) – Venzo & Pelosio, p. 76, pl. 34, figs 15-17.

Material and dimensions – Maximum height 2.9 mm, width 1.3 mm. **CO**: NHMW 2019/0167/0078 (5). **VC**: NHMW 2019/0167/0127-0128 (2), NHMW 2019/0167/0568 (33). **VQ**: NHMW 2019/0167/0272 (1). **VS**: NHMW 2019/0167/0816 (2). **VA**: NHMW 2019/0167/0292 (5). **EL**: 2019/0167/0635 (23).

Discussion – *Parthenina interstincta* (J. Adams, 1797) is characterised by its turriform profile, type C protoconch, almost straight-sided spire whorls separated by a V-shaped suture, axial sculpture of about 20 elevated orthocline robust ribs, roughly equal in width to their interspaces, that weaken over the base and on spire whorls one or two thin spiral cords placed on the abapical half of the whorl, 2-3 on the last whorl. The columella bears a well-developed fold and there is no umbilicus. Other European Mediterranean Pliocene to present-day turriform species with almost flat-side spire whorls and similar spiral sculpture are: *P. suturalis* (Philippi, 1844) that differs in being taller, slenderer, with more numerous orthocline ribs that are flattened and somewhat flexuous, *P. terebellum* (Philippi, 1844) that is again taller, with a more acute apex, and a similar number of ribs, but wider. *Parthenina tragulaeformis* (Fekih, 1969), from the Mediterranean Pliocene of Tunisia and Italy (Chirli & Micali, 2011), is even slenderer and taller turriform, with a deep, broad, V-shaped suture and 18-20 very broad, strongly prosocline flattened ribs.

Distribution – Middle Miocene: Paratethys, Poland (Friedberg, 1923); Proto-Mediterranean (Serravallian): Antalya Basin, Turkey (İslamoğlu & Taner, 2003), Karaman Basin (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian), NW France (Landau *et al*., 2020), southern Spain (Cárdenas *et al*., 2019); Proto-Mediterranean (Tortonian and Messinian), Italy (Moroni, 1955; Venzo & Pelosio, 1963). Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Chirli, 1984; Crovato & Micali, 1992a; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018), Tunisia (Fekih, 1969). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0283); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cossmann, 1921; Greco, 1971; Malatesta, 1974; Ferrero Mortara *et al*., 1984; Crovato & Micali, 1992a). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Gianolla *et al*., 2010); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic, Scandinavia, England (Nordsieck, 1972b; Graham, 1988; Høisæter, 2014), Madeira and Selvagens Islands (Segers *et al*., 2009), south to Morocco, Canary Islands (Hernández *et al*., 2011), Cape Verde Islands (Van Aartsen *et al*., 2000; Rolán, 2005), into western Mediterranean (Bucquoy *et al*., 1882; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011), Black Sea (Wilke & Van Aartsen, 1998).

***Parthenina juliae* (de Folin, 1872)**
Plate 70, figs 1-2

*1869 *Truncatella Juliae* de Folin *in* de Folin & Périer, p. 49, pl. 2, fig. 4.
1933 *Pyrgulina ordita* Coen, p. 52, 165, pl. 4, fig. 41.
1933 *Pyrgulina vixstriata* Coen, p. 52, 165, pl. 4, fig. 38.
1977 *Chrysallida juliae* (De Folin) – Van Aartsen, p 55, 58, pl. 2, fig. 13.
1984 *Chrysallida juliae* (Folin, 1871[*sic*]) – Chirli, p. 26, fig. 5.
1996 *Chrysallida juliae* (de Folin, 1872) – Peñas *et al*., p. 24, figs 25, 26.
1998 *Chrysallida juliae* (de Folin, 1872) – Peñas & Rolán, p. 54, figs 149-151.
2001 *Chrysallida juliae* (de Folin, 1872) – Cachia *et al*., p. 89, pl. 14, fig. 3.
2008 *Chrysallida* aff. *juliae* (Folin, 1871[*sic*]) – Chirli & Micali, p. 42, figs M, N.
2011 *Chrysallida juliae* (Folin, 1872) – Chirli & Micali, p. 39, pl. 12, figs 6-10.
2011 *Chrysallida juliae* (Folin, 1872) – Öztürk *et al*., p. 67, fig. 13.
2011 *Chrysallida juliae* (de Folin, 1872) – Hernández *et al*., p. 250, figs 86M-N.
2014 *Parthenina juliae* (de Folin, 1872) – Giannuzzi-Savelli *et al*., p. 70, figs 199, 200, appendix p. 23, 70.
2015 *Parthenina juliae* (de Folin, 1872) – Micali *et al*., fig. 23 (holotype of *P. ordita* Coen, 1933), 27, 39 (paralectotypes of *P. vixstriata* Coen, 1933), 43.
2018 *Parthenina juliae* (de Folin, 1872) – Trigo *et al*., p. 361, fig. 11.

Material and dimensions – Maximum height 2.6 mm, width 1.0 mm. **EL**: NHMW 2019/0167/0733 (1), NHMW 2019/0167/0734 (1).

Discussion – *Parthenina juliae* (de Folin, 1872) is characterised by its small subcylindrical shell, type C protoconch, teleoconch of up to five weakly convex whorls, separated by a moderately impressed suture, sculpture of about twenty narrow, opisthocline, flexuous ribs that extend onto the base, crossed by narrow cords on the abapical part of the whorl, 3-4 on penultimate whorl, 5-7 on last whorl, the cords also extending over the base. The umbilical chink is very narrow and the columellar without a fold.

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992a; Chirli, 1984; Chirli & Micali, 2011, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic from NW Spain (Van der Linden & Eikenboom, 1992; Trigo *et al*., 2018), southwards to Senegal and Canary Islands (Peñas & Rolán, 1998; Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*.,

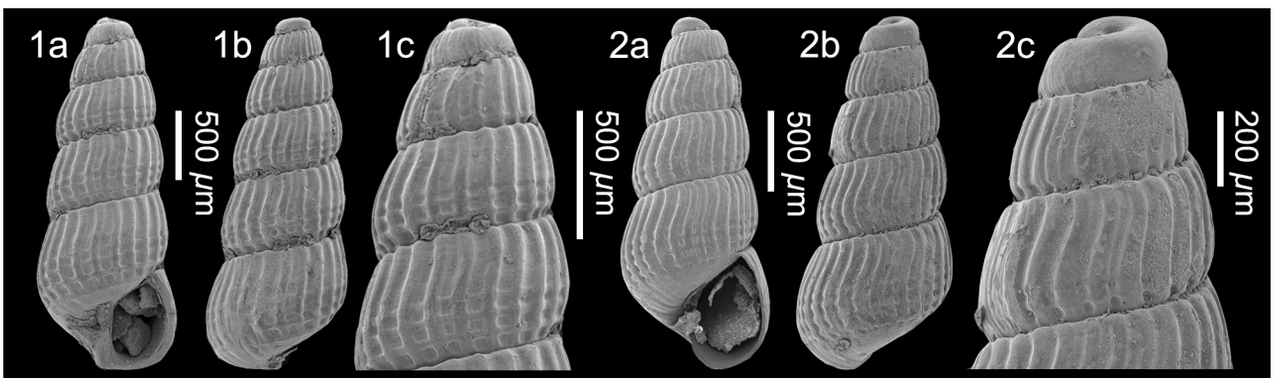

Plate 70. *Parthenina juliae* (de Folin, 1872); 1. NHMW 2019/0167/0733, height 2.6 mm, width 1.0 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0734, height 2.2 mm, width 930 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

2009), into western Mediterranean (Van der Linden & Eikenboom, 1992; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Van der Linden & Eikenboom, 1992; Micali & Palazzi, 1992; Öztürk *et al*., 2011; Giannuzzi-Savelli *et al*., 2014).

***Parthenina monozona* (Brusina, 1869)**
Plate 71, figs 1-2

*1869	*Odostomia monozona* Brusina, p. 240.
1882	*Odostomia monozona* Brusina – Bucquoy *et al*., p. 173, pl. 20, figs 12, 13.
1884	*Pyrgulina intermixta* Monterosato, p. 87.
1914	*Parthenina intermixta* Mtrs. – Cerulli-Irelli, p. 261 [435], pl. 22 [54], figs 7-9.
1969	*Pyrgulina* (*Parthenina*) *intermixta* Monterosato – Fekih, p. 19, pl. 3, fig. 3.
1977	*Chrysallida intermixta* (Mtrs.) – Van Aartsen, p. 57, 58, pl. 3, fig. 21.
1992	*Chrysallida intermixta* (Monterosato, 1884) – Van der Linden & Eikenboom, p. 20, fig. 33.
1992	*Chrysallida rara* Gaglini, p. 149, fig. 130.
2001	*Chrysallida intermixta* (Monterosato, 1884) – Cachia *et al*., p. 87, pl. 13, fig. 11.
2011	*Chrysallida intermixta* (Monterosato, 1884) – Chirli & Micali, p. 34, pl. 11, figs 1-5.
2011	*Chrysallida intermixta* (Monterosato, 1884) – Öztürk *et al*., p. 64, fig. 11.
2014	*Parthenina monozona* (Brusina, 1869) – Giannuzzi-Savelli *et al*., p. 64, figs 163-168, appendix p. 19, 67.
2015	*Parthenina monozona* (Brusina, 1869) – Micali *et al*., p. 521, figs 1-12 (*cum syn*.).
2018	*Chrysallida intermixta* (Monterosato, 1884) – Trigo *et al*., p. 361, fig. 3.
2020	*Parthenina monozona* (Brusina, 1869) – Landau *et al*., p. 313, pl. 40, fig. 1.

Material and dimensions – Maximum height 1.8 mm, width 770 μm. **VC**: NHMW 2019/0167/0697 (3). **EL**: NHMW 2019/0167/0620-0621 (2), NHMW 2019/0167/0622 (1).

Discussion – *Parthenina monozona* (Brusina, 1869) is characterised by its tall conical shell, type B protoconch, up to 6-7 weakly convex teleoconch whorls, sculpture of 18-22 strong, orthocline ribs slightly narrower than half the width of their intervals, crossed by a single abapical cord on spire whorls, two on the last whorl. The synonymy of *Pyrgulina intermixta* Monterosato, 1884 was

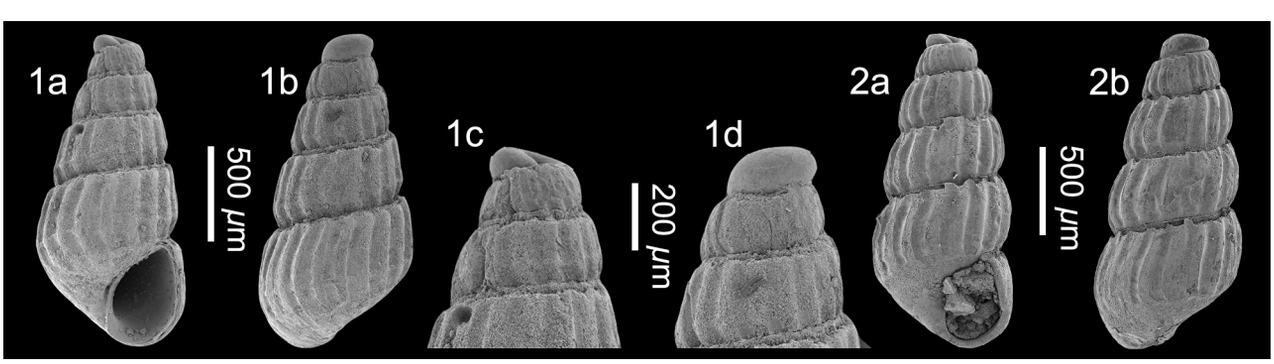

Plate 71. *Parthenina monozona* (Brusina, 1869); 1. NHMW 2019/0167/0620, height 1.7 mm, width 760 μm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0621, height 1.8 mm, width 770 μm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

discussed at length by Micali *et al*. (2015), and a detailed chresonymy given. The specimens from Estepona fit within the relatively wide range of variability seen in this species, although the microscopic spiral threads described by Van der Linden & Eikenboom (1992, p. 27), Chirli & Micali (2011, p. 35) and Micali *et al*. (2015, p. 523) do not seem to be present. However, this microsculpture is only visible in very fresh specimens.

Distribution – Upper Miocene (Tortonian): NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2014), Tunisia (Fekih, 1969). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0333); western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914). Present-day: Atlantic from northwestern Spain (Trigo *et al*., 2018), southwards into whole Mediterranean (Bucquoy *et al*., 1882; Van der Linden & Eikenboom, 1992; Cachia *et al*., 2001; Öztürk *et al*., 2011; Micali *et al*., 2015).

Parthenina monterosatii **(Clessin, 1900)**
Plate 72, figs 1-2

1878a *Odostomia brevicula* Monterosato, p. 93 (*nomen nudum*) [*non* Jeffreys, 1883c = *Turbonilla amoena* (Monterosato, 1878)].
1884 *Pyrgulina brevicula* Monts – Monterosato, p. 88 (*nomen nudum*).
*1900 *Parthenia monterosatii* Clessin, p. 188.
1903 *Parthenia* (*Pyrgulina*) *alleryi* Kobelt, p. 134, pl. 73, figs 9-10.
1933 *Tiberia* (*Tiberiella*) *pretiosa* Coen, p. 164.
1977 *Chrysallida alleryi* (Kobelt) – Van Aartsen, p. 53, 58, pl. 4, fig. 23.
1992 *Chrysallida alleryi* (Kobelt, 1903) – Van der Linden & Eikenboom, p. 12.
1993 *Chrysallida monterosatii* (Clessin, 1900) – Micali *et al*., p. 148, fig. 2.
2004 *Chrysallida monterosatii* (Clessin, 1900) – Solustri & Micali, p. 65, fig. 5c.
2011 *Chrysallida* aff. *monterosatii* (Clessin, 1900) – Chirli & Micali, p. 40, pl. 12, figs 11-15.
2014 *Parthenina monterosati* [*lapsus*] (Clessin, 1900) – Giannuzzi-Savelli *et al*., p. 64, fig. 169, appendix p. 19, 67 (correct spelling used in appendix).

Material and dimensions – Maximum height 3.1 mm, width 970 μm. **CO**: NHMW 2019/0167/0452-0453 (2), NHMW 2019/0167/0454 (1). **VA**: NHMW 2019/0167/0288 (1). **EL**: 2019/0167/0563-0564 (2), NHMW 2019/0167/0565 (15).

Discussion – *Parthenina monterosatii* (Clessin, 1900) is characterised by its elongated, conico-cylindrical profile, type B protoconch, teleoconch of up to six weakly convex whorls, separated by a deeply impressed suture, often the first teleoconch whorl, or part of it, is smooth or with very weak sculptured, 20-22 orthocline sinuous axial ribs, separated by interspaces narrower than the ribs, and spiral sculpture of one well-developed, narrow abapically placed cord visible only in the axial interspaces. The last whorl is rounded at the base, the axials end relatively abruptly above the base, that bears a very narrow umbilical chink, and the columella has a robust columellar fold. The fine spiral threads in the axial interspaces described by (Chirli & Micali, 2011, p. 41) are probably abraded. The Italian Pliocene specimen illustrated by Chirli & Micali (2011, pl. 12, figs 11-15) probably does represent this species, although we note that the protoconch in the Estepona specimens is of type B tending to C, whereas that illustrated from Italy is higher and clearly type B.

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); Present-day: central Mediterranean (Micali *et al*., 1993; Solustri & Micali, 2004; Giannuzzi-Savelli *et al*., 2014).

Parthenina silviae **(Chirli & Micali, 2011)**
Plate 73, figs 1-4

*2011 *Chrysallida silviae* Chirli & Micali, p. 43, pl. 14, figs 1-7.

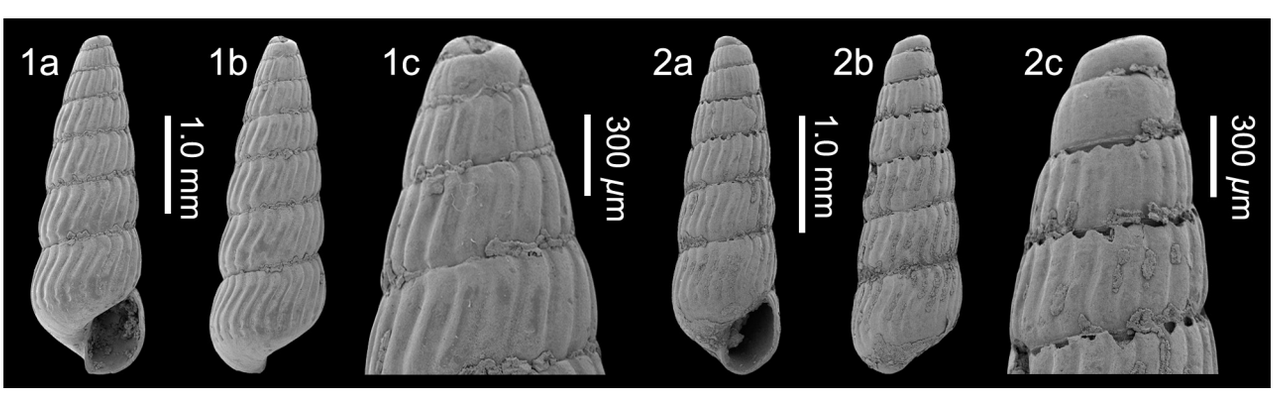

Plate 72. *Parthenina monterosatii* (Clessin, 1900); 1. NHMW 2019/0167/0452, height 2.7 mm, width 980 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0453, height 3.1 mm, width 970 μm, 2c, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

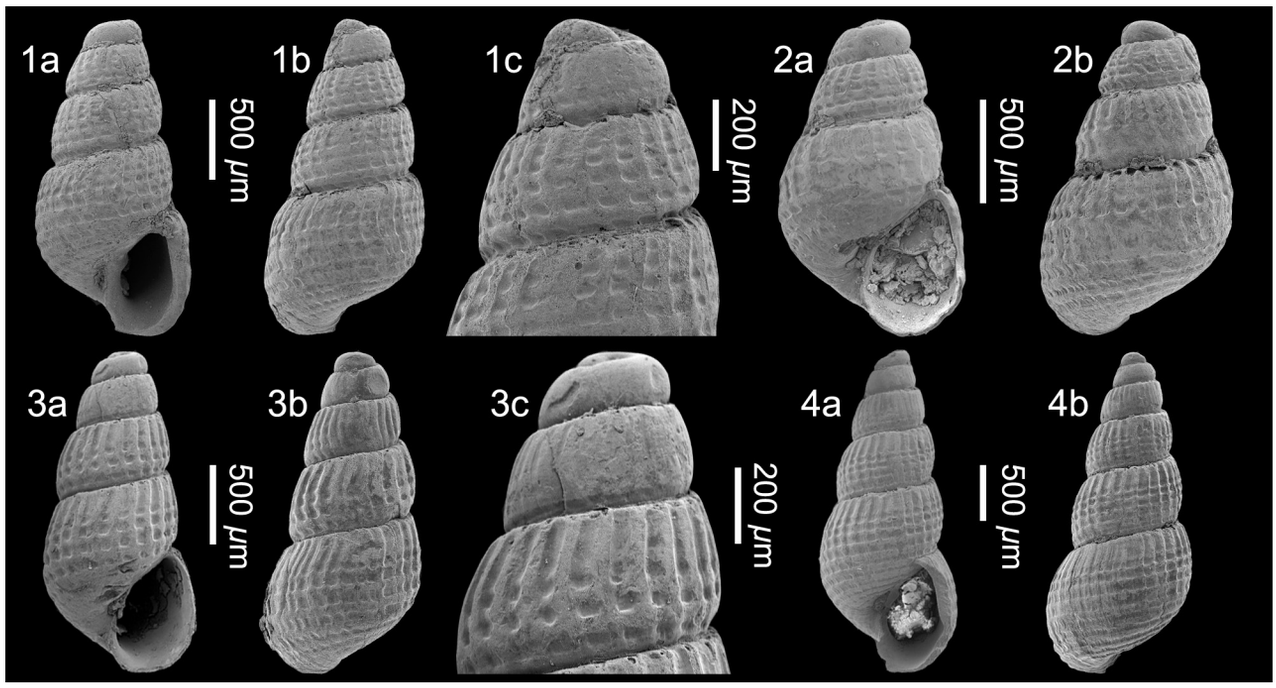

Plate 73. *Parthenina silviae* (Chirli & Micali, 2011); 1. NHMW 2019/0167/0273, height 2.1 mm, width 965 µm, 1c, detail of protoconch; 2. NHMW 2019/0167/0456 (subadult), height 1.6 mm, width 945 µm. Velerín conglomerates, Velerín. 3. NHMW 2019/0167/0675, height 2.0 mm, width 955 µm, 3c, detail of protoconch; 4. NHMW 2019/0167/0676, height 2.9 mm, width 1.2 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 2.9 mm, width 1.2 mm. **CO**: NHMW 2019/0167/0273 (1), NHMW 2019/0167/0456 (1), NHMW 2019/0167/0717 (1). **EL**: NHMW 2019/0167/0675-0676 (2), NHMW 2019/0167/0677 (50+).

Discussion – *Parthenina silviae* (Chirli & Micali, 2011) is characterised by its small size, type B protoconch, teleoconch of up to 3.5 weakly convex whorls, separated by a deeply impressed suture, axial sculpture of narrow, close-set, slightly flexuous, orthocline axial ribs, 26-28 on penultimate whorl, 4-5 spiral cords, roughly equal in width to the ribs, forming fine-meshed cancellate sculpture. The last whorl is about 58-68% of total height, strongly convex at base, the sculpture persists over the base, where the cords are more robust, and a narrow umbilical chink is present. The aperture is pyriform, the columella weakly excavated, bearing a small fold. The Estepona specimens from the Velerín conglomerates are somewhat abraded, making the sculpture seem flatter than in the Italian specimens illustrated by Chirli & Micali (2011, pl. 14, figs 1-7). For comparison see Chirli & Micali (2011, p. 44).

The cancellate sculpture, and robust spiral cords over the base, clearly differentiate *P. silviae* from all of its congeners. It is superficially similar to *Pyrgulina enricoi* (Chirli & Micali, 2011), but that species has a more depressed protoconch, a less deeply incised suture, and finer cancellate sculpture. *Parthenina biumbilicata* Pimenta, 2012 from Brazil differs in having the spiral cords covering only two-thirds adapical region of each whorl, instead of covering the entire whorl. In addition, no columella fold is mentioned in the original description, nor visible in the photographs.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Parthenina suturalis* (Philippi, 1844)**
Plate 74, fig. 1

	1836	*Rissoa striata* Philippi, p. 154, pl. 10, fig. 8 (*non* J. Adams, 1797).
*	1844	*Chemnitzia suturalis* Philippi, p. 129.
	1972b	*Chrysallida* (*Parthenina*) *suturalis* (Philippi, 1844) – Nordsieck, p. 92, pl. PI, fig. 9.
	1977	*Chrysallida suturalis* (Phil.) – Van Aartsen, p. 56, 58, pl. 2, fig. 16.
	1986	*Chrysallida suturalis* (Philippi, 1844) – Fretter *et al*., p. 562, fig. 379.
	1988	*Chrysallida suturalis* (Philippi, 1844) – Graham, p. 548, fig. 235.
	1992	*Chrysallida suturalis* (Philippi, 1844) – Van der Linden & Eikenboom, p. 14, fig. 22.
	1996	*Chrysallida suturalis* (Philippi, 1844) – Peñas *et al*., p. 28, figs 34, 35.
	2001	*Chrysallida suturalis* (Philippi, 1844) – Cachia *et al*., p. 90, pl. 14, fig. 6.
	2011	*Chrysallida suturalis* (Philippi, 1844) – Öztürk *et al*., p. 72, fig. 19.

2011 *Chrysallida suturalis* (Philippi, 1844) – Chirli & Micali, p. 44, pl. 14, figs 11-15.
2011 *Chrysallida suturalis* (Philippi, 1844) – Hernández *et al*., p. 252, figs 84M-N.
2011 *Parthenina suturalis* (Philippi, 1844) – Lygre *et al*., p. 478, figs 1C-F.
2013 *Chrysallida suturalis* (Philippi, 1844) – Landau *et al*., p. 315, pl. 75, fig. 11.
2014 *Parthenina suturalis* (Philippi, 1844) – Giannuzzi-Savelli *et al*., p. 68, figs 182-183, appendix p. 21, 68.
2018 *Parthenina suturalis* (Philippi, 1844) – Trigo *et al*., p. 361, fig. 12.

Material and dimensions – Maximum height 2.5 mm, width 833 μm. **VS**: NHMW 2019/0167/0444 (1).

Discussion – *Parthenina suturalis* (Philippi, 1844) is characterised by its elongate conical profile, type C protoconch, teleoconch of up to six almost straight-sided convex whorls, slightly angular at the periphery placed at about one-quarter whorl height, separated by a moderately impressed, strongly oblique suture, sculpture of 20-25 straight, orthocline to slightly prosocline ribs, equal to wider than their interspaces, single sharp spiral cord present at about one-quarter whorl height, visible in axial interspaces, last whorl elongate, with second cord delimiting base, ribs weakening over base, umbilical chink insignificant, and a small columellar fold. As in other *Parthenina* species discussed herein, the spiral microsculpture in the axial interspaces described by Van der Linden & Eikenboom (1992, p. 14) is not evident in the Estepona specimens, probably due to imperfect preservation.
Parthenina suturalis differs from other European species with one cord on spire whorls and two on the last whorl: *P. interstincta* (J. Adams, 1797) is less slender, with fewer ribs that usually do not persist over the base; *P. emaciata* (Brusina, 1866) has more convex whorls and more sinuous ribs; *P. terebellum* (Philippi, 1844) is larger, less slender, and a stronger columellar fold; *P. penchynati* (Bucquoy, Dautzenberg & Dollfus, 1883) is less slender, less cylindrical, with less convex whorls, separated by a channeled suture, and the ribs extend over the base.

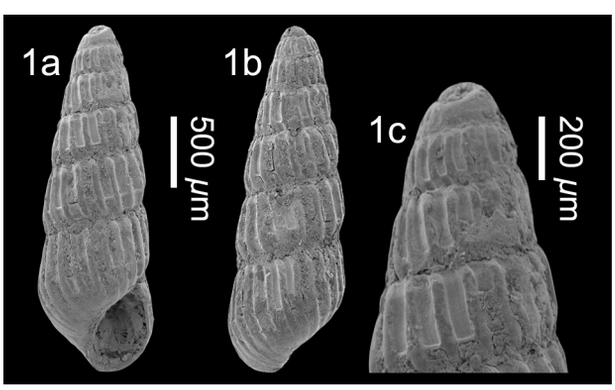

Plate 74. *Parthenina suturalis* (Philippi, 1844); 1. NHMW 2019/0167/0444, height 2.4 mm, width 815 μm, 1c, detail of protoconch (SEM image). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Distribution – Middle Miocene: northeastern Atlantic, Azores (Ferreira, 1955); Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992a; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Tabanelli & Segurini, 1994). Present-day; Atlantic, British Isles (Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), south to Canary Islands (Hernández *et al*., 2011), West Africa to Nigeria (Lygre *et al*., 2011), western Mediterranean (Peñas *et al*., 1996) central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011).

Parthenina terebellum **(Philippi, 1844)**
Plate 75, figs 1-3

*1844 *Chemnitzia terebellum* Philippi, p. 138, pl. 24, fig. 12.
1864 *Odostomia Moulinsiana* Fischer, p. 70.
1886 *Parthenina Desmoulinsiana* Locard, p. 221.
1920 *Pyrgulina interstincta* var. *terebellum* (Philippi) – Harmer, p. 577, pl. 49, fig. 49.
1933 *Pyrgulina denticulus* Coen, p. 52, 164, pl. 4, fig. 34.
1933 *Pyrgulina pyrgulella* Coen, p. 52, 165, pl. 4, fig. 42.
1933 *Pyrgulina cylindracea* Coen, p. 54, 165, pl. 4, fig. 43.
1933 *Pyrgulina mitis* Coen, p. 54, 165, pl. 4, fig. 44.
1954 *Chrysallida* (*Pyrgulina*) *interstincta terebellum* Phil. – Strausz, p. 21, Pl. 1, fig. 6.
1972b *Chrysallida* (*Perparthenina*) *terebellum* (Philippi, 1844) – Nordsieck, p. 94, pl. PI, fig. 18.
1977 *Chrysallida terebellum* (Phil.) – Van Aartsen, p. 56, 58, pl. 3, fig. 18.
1984 *Chrysallida terebellum* (Nordsieck,?) [*sic*] – Chirli, p. 31, fig. 8.
1988 *Chrysallida terebellum* (Philippi, 1844) – Graham, p. 550, fig. 236.
1996 *Chrysallida terebellum* (Philippi, 1844) – Peñas *et al*., p. 30, figs 38-39.
1998 *Chrysallida terebellum* (Philippi, 1844) – Wilke & Van Aartsen, p. 11, pl. 5, fig. 20a, b.
2001 *Chrysallida terebellum* (Philippi, 1844) – Cachia *et al*., p. 90, pl. 14, fig. 7.
2004 *Chrysallida terebellum* (Philippi, 1844) – Solustri & Micali, p. 65, fig. 5d.
2011 *Chrysallida terebellum* (Philippi, 1844) – Chirli & Micali, p. 15, figs 1-5.
2011 *Chrysallida terebellum* (Philippi, 1844) – Öztürk *et al*., p. 74, fig 20A-E.
2014 *Parthenina terebellum* (Philippi, 1844) – Giannuzzi-Savelli *et al*., p. 66, figs 179-181, appendix p. 21, 68.
2018 *Parthenina terebellum* (Philippi, 1844) – Trigo *et al*., p. 361, fig. 13.

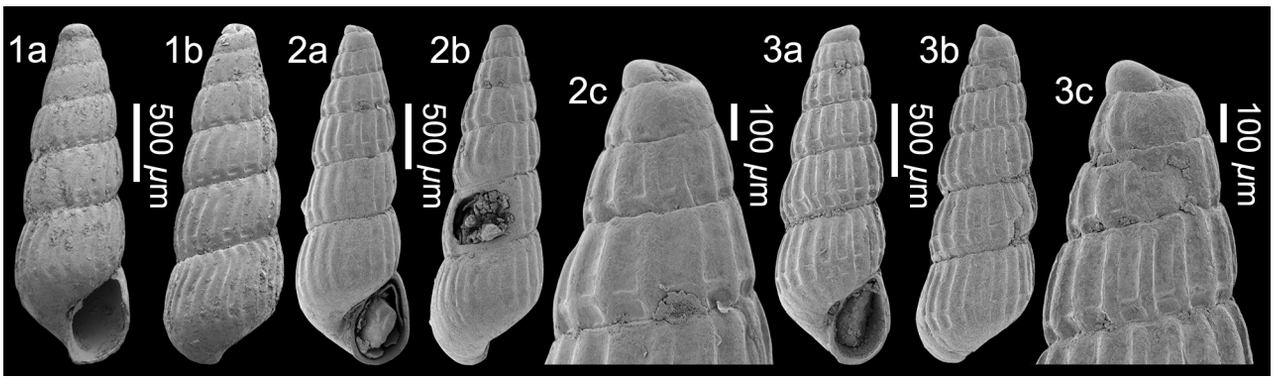

Plate 75. *Parthenina terebellum* (Philippi, 1844); 1. NHMW 2019/0167/0132, height 2.2 mm, width 730 μm. Velerín carretera, Velerín. 2. NHMW 2019/0167/0784, height 2.6 mm, width 870 μm, 2c, detail of protoconch; 3. NHMW 2019/0167/0785, height 2.4 mm, width 780 μm, 3c, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Material and dimensions – Maximum height 2.4 mm, width 780 μm. **VC**: NHMW 2019/0167/0132 (1), NHMW 2019/0167/0133 (3). **EL**: NHMW 2019/0167/0784-0785 (2), NHMW 2019/0167/0786 (11).

Discussion – *Parthenina terebellum* (Philippi, 1844) is characterised by its tall turriform shell, type B tending to C protoconch, almost flat to weakly convex whorls, and sculpture of about 20 flattened opisthocline ribs that are flexuous in some specimens, and do not persist onto the base. Spiral sculpture consists of one abapically placed spiral cord on spire whorls, two on the last whorl. For comparison in this *Parthenina* group see above under *Parthenina interstincta* (J. Adams, 1797). This species is higly variable, as suggested by the numerous names proposed by Coen (1933), based on forms of this species (PM personal observation).

Distribution – Middle Miocene: Paratethys, Hungary (Strausz, 1954). Upper Miocene: Proto-Mediterranean (Tortonian), Italy (Seguenza, 1862). Lower Pliocene: central Mediterranean, Italy (Chirli, 1984; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: Atlantic: St. Erth, England (Harmer, 1920); central Mediterranean, Italy (Ruggieri, 1973; Dell'Angelo & Forli, 1995). Present-day: Atlantic, southern Ireland (Graham, 1988), northwestern Spain (Trigo *et al*., 2018), Azores, Madeira (Nordsieck, 1972b), southwards into western Mediterranean; (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Solustri & Micali, 2004; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *et al*., 2011), Black Sea (Wilke & Van Aartsen, 1998).

***Parthenina tragulaeformis* (Fekih, 1969)**
Plate 76, fig. 1

*1969 *Pyrgulina tragulaeformis* Fekih, p. 25, pl. 4, fig. 3.
2011 *Chrysallida tragulaeformis* (Fekih, 1969) – Chirli & Micali, p. 46, pl. 15, figs 6-10.

Material and dimensions – Height 2.7 mm, width 835 μm. **EL**: NHMW 2019/0167/0807 (1).

Discussion – The single specimen from the Estepona assemblages is poorly preserved and the protoconch is abraded, however, it can be ascribed with relative certainty to *Parthenina tragulaeformis* (Fekih, 1969). That species is characterised by its tall, conical profile with a blunt apex, type C protoconch set at an angle of about 135° to the main shell axis, teleoconch of 6-7 convex whorls separated by a deeply incised suture, sculptured by 18-20 straight prosocline ribs separated by narrow interspaces that do not persist onto the base. Spiral sculpture consists of a single spiral cord placed just above the suture on spire whorls and at the periphery on the last whorl. The last whorl is weakly inflated, the base delimited by a smooth disc at which the axial ribs stop abruptly. The aperture is pyriform, the columella oblique with a mid-strength fold placed mid-columella.
Similar to *P. interstincta* (J. Adams, 1797), it differs in being more elongated, with broader ribs that are always prosocline. *Parthenina tragulaeformis* differs from *P. terebellum* (Philippi, 1844) in being more elongate, the protoconch is broader and more depressed, the whorls lower separated by a deeper suture, and the ribs proso-

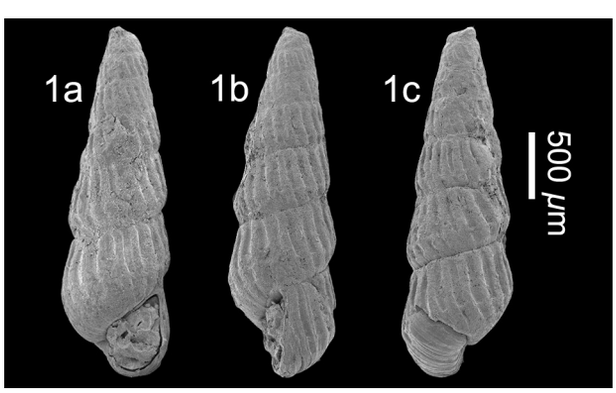

Plate 76. *Parthenina tragulaeformis* (Fekih, 1969); 1. NHMW 2019/0167/0807, height 2.7 mm, width 835 μm (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

cline instead of opisthocline (Chirli & Micali, 2011, p. 47).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0331); western Mediterranean, Estepona Basin, Spain (this paper).

***Parthenina turbonillaeformis* (Van Aartsen, Gittenberger & Goud, 2000)**
Plate 77, figs 1-2

*2000	*Chrysallida turbonillaeformis* Van Aartsen, Gittenberger & Goud, p. 42, figs 49, 65.
2005	*Chrysallida turbonillaeformis* Van Aartsen, Gittenberger & Goud, 2000 – Rolán, p. 192, fig. 892.

Material and dimensions – Maximum height 1.8 mm, width 750 μm. **EL**: NHMW 2019/0167/0797-0798 (2), NHMW 2019/0167/0799 (3).

Discussion – *Parthenina turbonillaeformis* (Van Aartsen, Gittenberger & Goud, 2000) is characterised by its tall, conical profile with a blunt apex, type C protoconch, teleoconch of up to seven almost flat-sided whorls separated by a moderately incised suture, sculptured by 12-16 opisthocline inverted S-shape ribs, slightly narrower than their interspaces that do not persist onto the base; spiral sculpture absent, umbilicus and columellar fold absent. As noted by Van Aartsen *et al*. (2000, p. 43) this species resembles a small turbonillid, but differs in its type C protoconch which does not occur in turbonillids. It is most similar to *Strioturbonilla sigmoidea* (Monterosato, 1880), but shells of that species are slenderer and have spiral sculpture. This is the first fossil record for this species that today is found only around the Cape Verde Islands (Rolán, 2005, p. 192).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Cape Verde Islands (Van Aartsen *et al*., 2000; Rolán, 2005).

Genus *Pyrgulina* A. Adams, 1863

Type species – *Pyrgulina decussata* A. Adams, 1863, by subsequent designation, Fischer, 1885, p. 788 as "*O.*[*dostomia*] *decussata,* Montagu" a *lapsus* corrected per ICZN 1999 Art. 67.7. Cossmann (1921, p. 255 subsequently repeated P. Fischer's designation, including his *lapsus*. The subsequent type designation of *Chrysallida casta* A. Adams, 1861, by Dall & Bartsch, 1904, is invalid (comment personal communication BL from Patrick LaFollette; 25/08/2021). Present-day, Japan.

1863	*Pyrgulina* A. Adams, p. 1, 4.
1910	*Eupyrgulina* Melvill, p. 198. Type species (by subsequent designation, Schander *et al*., 1999): *Pyrgulina dautzenbergi* Melvill, 1910, present-day, India.

Note – We follow Peñas & Rolán (2017, p. 131) in including in this genus species with conspicuous axial sculpture and spiral sculpture which occupies the entire height of the whorls, including the base. The spiral sculpture may be formed by grooves, threads or cordlets, and may be present only in the rib interspaces or override them.

***Pyrgulina cancellatissima* Landau, Micali, Van Dingenen & Ceulemans, 2020**
Plate 78, figs 1-3

*2020	*Pyrgulina cancellatissima* Landau, Micali, Van Dingenen & Ceulemans, p. 319, pl. 48, figs 1-3.

Material and dimensions – Maximum height 2.8 mm, width 1.4 mm. **VC**: NHMW 2019/0167/0197 (1), NHMW 2019/0167/0198 (22), NHMW 2019/0167/0543-0544 (2). **EL**: NHMW 2019/0167/0788 (10).

Discussion – *Pyrgulina cancellatissima* Landau, Micali, Van Dingenen & Ceulemans, 2020 is characterised by its small size, type B protoconch tending to C, four teleoconch whorls with finely cancellate sculpture, axials

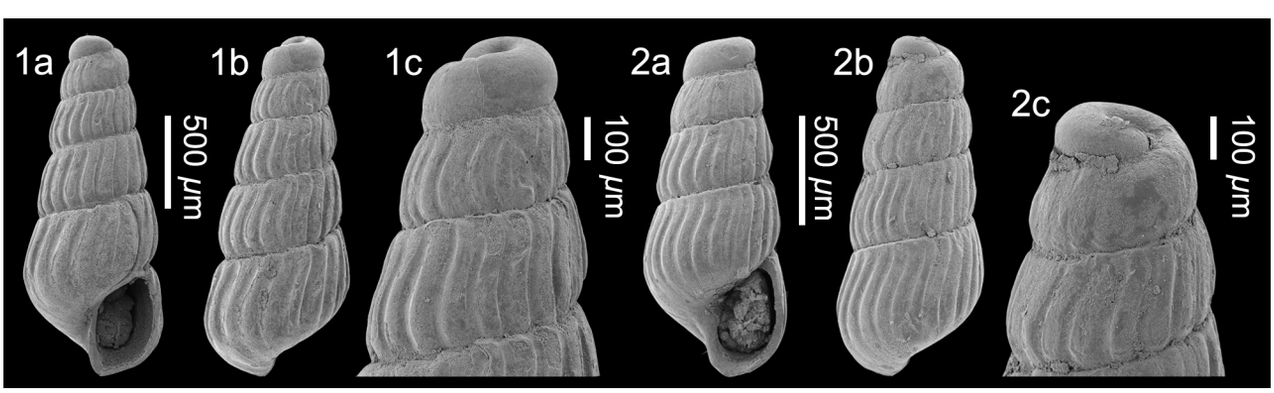

Plate 77. *Parthenina turbonillaeformis* (Van Aartsen, Gittenberger & Goud, 2000); 1. NHMW 2019/0167/0797, height 1.8 mm, width 750 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0798, height 1.6 mm, width 655 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

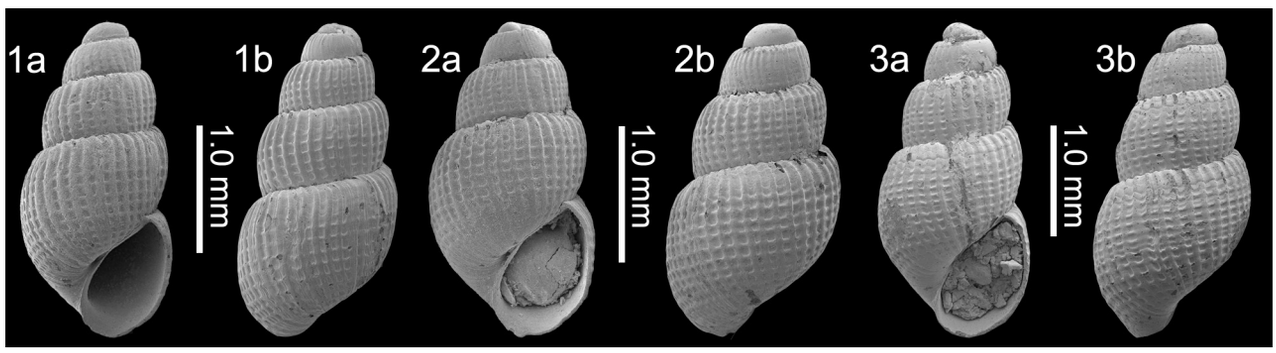

Plate 78. *Pyrgulina cancellatissima* Landau, Micali, Van Dingenen & Ceulemans, 2020; 1. NHMW 2019/0167/0543, height 2.7 mm, width 1.2 mm; 2. NHMW 2019/0167/0544, height 2.3 mm, width 1.2 mm; 3. NHMW 2019/0167/0197, height 2.8 mm, width 1.4 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

slightly predominant, pitted interspaces, weak columellar fold. The specimen illustrated by Brunetti & Cresti (2018, p. 106, fig. 456 as *Parthenina* sp. is similar, but stouter, with lower, more inflated whorls, and has slightly coarser cancellate sculpture in which the ribs are somewhat stronger. Mauro Brunetti has kindly compared the Estepona illustrations with the Italian specimen and confirms they are not conspecific (personal comm. PM 07/02/2021). For full discussion and comparison see Landau *et al*. (2020, p. 320).

Distribution – Upper Miocene (Tortonian): NW France (Landau *et al*., 2020). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Pyrgulina enricoi* (Chirli & Micali, 2011)**
Plate 79, figs 1-2

*2011 *Chrysallida enricoi* Chirli & Micali, p. 23, pl. 7, figs 6-15.

Material and dimensions – Maximum height 3.2 mm, width 1.3 mm. **CO**: NHMW 2019/0167/0250 (3), NHMW 2019/0167/0747 (1). **VC**: NHMW 2019/0167/0266-0267 (2), NHMW 2019/0167/0268 (7); NHMW 2019/0167/0746 (1). **VA**: NHMW 2019/0167/0291 (1). **PQ**: NHMW 2019/0167/0299 (4). **EL**: NHMW 2019/0167/0791 (1).

Discussion – *Pyrgulina enricoi* (Chirli & Micali, 2011)

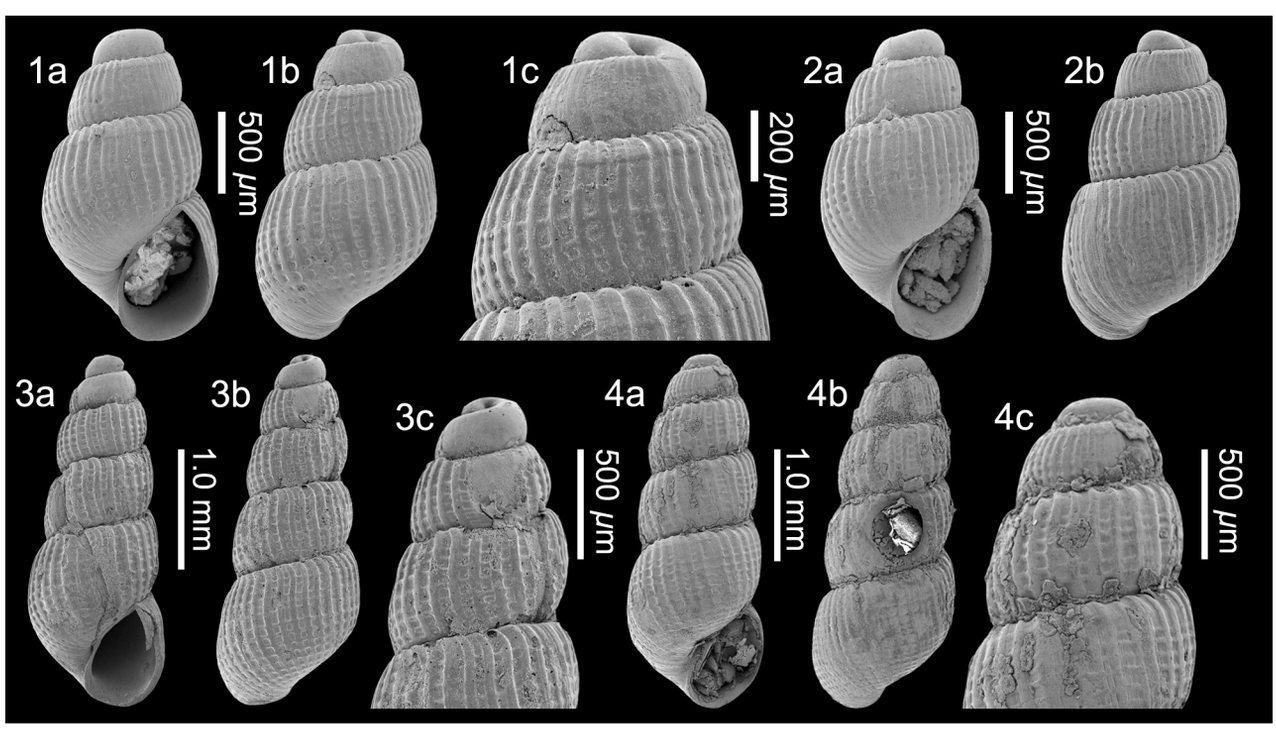

Plate 79. *Pyrgulina enricoi* (Chirli & Micali, 2011); 1. NHMW 2019/0167/0266, height 2.0 mm, width 1.0 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0267, height 1.9 mm, width 990 µm; 3. NHMW 2019/0167/0746, height 2.9 mm, width 1.1 mm, 3c, detail of protoconch. Velerín carretera. 4. NHMW 2019/0167/0747, height 3.2 mm, width 1.3 mm, 4c, detail of protoconch (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

is characterised by its small pupoid profile, protoconch type B tending to C, weakly convex teleoconch whorls with slightly flexuous orthocline to slightly prosocline axial ribs (22-24 on first whorl, 30-32 on penultimate) and fine, irregularly spaced spiral cords visible only in the axial interspaces (4 on first whorl, 5-7 on penultimate whorl), the axial ribs dominant, and small ovate aperture with a very small columellar fold. The specimens from Estepona are slightly smaller than those from the Italian Pliocene and probably subadult, with one teleoconch whorl less. *Pyrgulina enricoi* is most similar to *P. cancellatissima* Landau, Micali, Van Dingenen & Ceulemans, 2020 from the upper Miocene of northwestern France, but that species has a less pupoid profile, an even finer, denser cancellate sculpture with more numerous weaker spiral cords, the suture is not as deep, and the axials are less dominant, almost equal in width to the spirals.
Pyrgulina variornata Sacco, 1892 from the upper Pliocene of Italy has similar sculpture, but is taller and more cylindrical, the apex (based on original drawing) is more cap-shaped, the whorl profile is flatter mid-whorl, the ribs are more than 30, against about 20 on the last whorl, and the aperture is subquadrate [holotype figured by Ferrero Mortara *et al*. (1984, pl. 10, fig. 6)]. Unfortunately, the protoconch is missing on the holotype. For further comparison see Chirli & Micali (2011, p. 24).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0330); western Mediterranean, Estepona Basin, Spain (this paper).

***Pyrgulina marliesae* nov. sp.**
Plate 80, figs 1-3

?1992 *Charysallida* sp 1 – Cavallo & Repetto, p. 154, fig. 428.
?1992 *Charysallida* sp 2 – Cavallo & Repetto, p. 154, fig. 429.

Type material – **VC**: holotype NHMW 2019/0167/0569, height 3.0 mm, width 1.2 mm; paratype 1 NHMW 2019/0167/0570, height 5.4 mm, width 1.4 mm. **PQ**: paratype 2 NHMW 2019/0167/0088, height 2.8 mm, width 1.6 mm.

Other material – Maximum height 5.4 mm, width 1.4 mm. **VC**: NHMW 2019/0167/0087 (50+). **PQ**: NHMW 2019/0167/0089 (27).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Marlies Mulder, daughter of Henk Mulder, whose many years of tireless collecting in Estepona have contributed enormously in the preparation of this monograph. *Pyrgulina* gender feminine.

Diagnosis – Pyrgulina species of small size, thin shelled, scalate profile, type B tending to C, occasionally type B protoconch, up to four scalate whorls, well-delimited shallow-sloping subsutural ramp, finely sculptured, about 24 low ribs and 14 cords on penultimate whorl, weak columellar fold internally.

Description – Shell small, delicate, with squat to moderately tall scalate spire. Protoconch type B tending to C, in

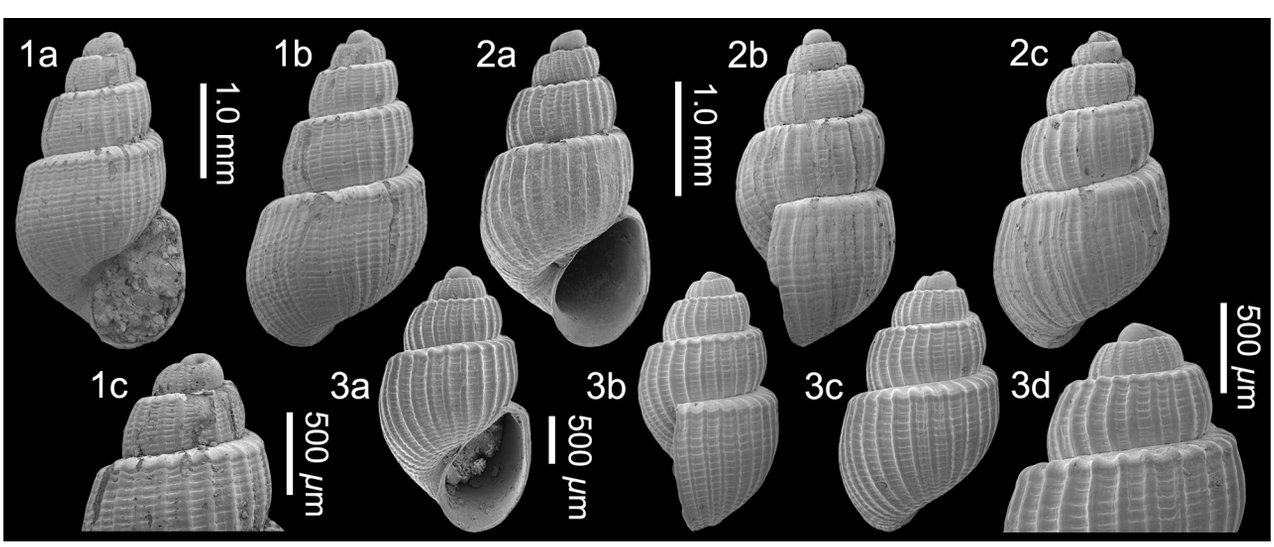

Plate 80. *Pyrgulina marliesae* nov. sp.; 1. **Holotype** NHMW 2019/0167/0569, height 3.0 mm, width 1.2 mm, 1c, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0570, height 5.4 mm, width 1.4 mm, Velerín carretera, Velerín. 3. **Paratype 2** NHMW 2019/0167/0088, height 2.8 mm, width 1.6 mm, 3d, detail of protoconch (SEM images). Parque Antena, Estepona, lower Piacenzian, upper Pliocene.

some specimens type B. Teleoconch of up to four 'barrel-shaped' slightly coronate whorls, separated by narrow, subhorizonal ramp, weakly convex below, periphery about one-third whorl height, separated by moderately impressed linear suture. Sculpture of narrow, orthocline to slightly prosocline ribs, about half the width of their interspaces, about 24 on penultimate whorl, weakening abapically, overrun by about 14 irregular narrow cords, separated by narrower grooves. Last whorl 56-63% total height, sharply angled below narrow subhorizontal subsutural ramp, straight sided to periphery, rounded at base, sculpture persists over base, narrow umbilical chink. Aperture subquadrate, outer lip thin, rounded, not flared abapically, columella very thin, excavated, bearing weak fold internally.

Discussion – *Pyrgulina marliesae* nov. sp. differs from *Pyrgulina stefanisi* (Jeffreys, 1869), *P. jeffreysi* (Bell, 1871) and *P. parvula* (Nyst, 1845) in being thinner shelled, in having a less intorted type B, or more often B tending to C, instead of type C protoconch, in having more squarely scalate whorls that are slightly coronate adapically, and in having finer and more numerous ribs and more numerous cords. *Pyrgulina variornata* Sacco, 1892 from the upper Pliocene of Italy has spiral sculpture with only 5-6 spiral cords, a less stepped profile and and the apex (based on original drawing) is more cap-shaped (holotype figured by Ferrero Mortara *et al*., 1984, pl. 10, fig. 6). Unfortunately, the protoconch is missing on the holotype. The Italian Pliocene specimen figured as *Chrysallida* sp. 1 and 2 by Cavallo & Repetto (1992, figs 428, 429) might represent this new species.
The present-day species *Pyrgulina jullieni* Dautzenberg, 1912 from West Africa shows an outline similar to the more elevated form that we have called *Pyrgulina* cf. *marliesae* (see below, Pl. 81, figs 1-2), but differs in having only 4-5 spiral cords, and a larger and markedly C-type protococh.
Pyrgulina marliesae is found mainly in the deeper water deposits (Velerín carretera, Parque Antena), where it is the most abundant of the Chrysallidini in the Estepona deposits. However, it probably also occurs in Italy (Cavallo & Repetto, 1992).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (?Cavallo & Repetto, 1992).

***Pyrgulina* cf. *marliesae* nov. sp.**
Plate 81, figs 1-2

Material and dimensions – Maximum height 4.1 mm, width 1.5 μm. **CO**: NHMW 2019/0167/0476 (1). **EL**: NHMW 2019/0167/0779 (1), NHMW 2019/0167/0780 (2).

Discussion – Closely similar to *Pyrgulina marliesae* nov. sp., but slenderer and taller spired. Initially considered just a tall-spired form, there do not seem to be any intermediates and we are unsure whether these taller specimens represent a separate species. We provisionally leave them in open nomenclature.

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

***Pyrgulina stefanisi* (Jeffreys, 1869)**
Plate 82, figs 1-4

*1869	*Rissoa Stefanisi* Jeffreys, p. 208.
?1920	*Menestho Stefanisi* (Jeffreys) – Harmer, p. 584, pl. 50, fig. 5.
1964	*Turboella* (*Thapsiella*) *menesthoides* Cossmann, 1921 – Brébion, p. 177, pl. 4, fig. 33.
1977	*Chrysallida pygmaea* (Grat.) – Van Aartsen, p. 54, 58, pl. 2, fig. 11 [*non* Grateloup, 1838 = *P. parvula* (Nyst, 1835), see Landau *et al*., 2020, p. 321].
1992	*Chrysallida stefanisi* (Jeffreys, 1869) – Van der Linden & Eikenboom (*partim*), p. 42, figs 51 only [fig. 52 = *P. jeffreysi* (Bell, 1871)].
1992	*Chrysallida stefanisi* (Jeffreys, 1869) – Cavallo & Repetto (*partim*), p. 154, fig. 427 right two specimens [left two = *P. jeffreysi* (Bell, 1871)].
1997	*Turbonilla rufa* (Philippi) – Ruiz Muñoz *et al*., p. 188, pl. 41, fig. 2 [*non Pyrgiscus rufus* (Philippi, 1836)].
2001	*Chrysallida stefanisi* (Jeffreys, 1869) – Cachia *et*

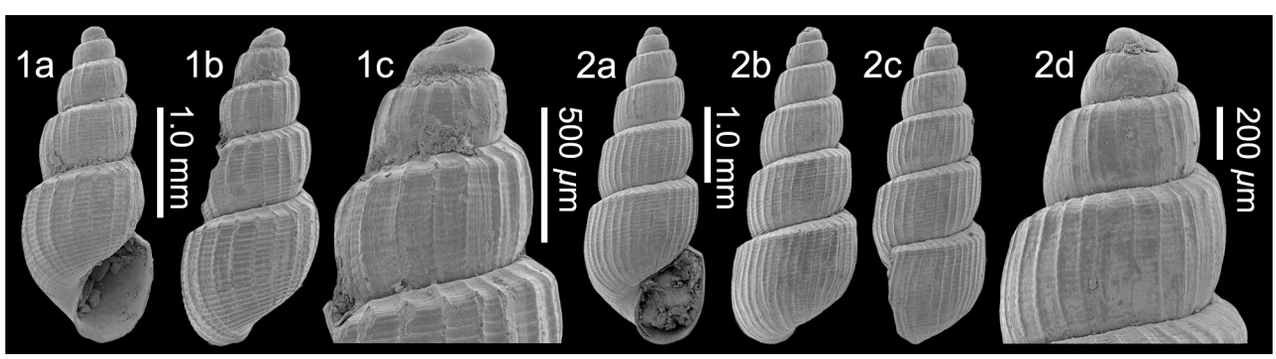

Plate 81. *Pyrgulina* cf. *marliesae* nov. sp.; 1. NHMW 2019/0167/0476, 3.3 mm, width 1.8 mm, 1c, detail of protoconch. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0779, 4.1 mm, width 1.5 mm, 2d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

al., p. 89, pl. 14, fig. 5.

2010 *Chrysallida stefanisi* (Jeffreys, 1869) – Sosso & Dell'Angelo, p. 51, unnumbered fig. P. 67 top left.

2011 *Chrysallida stefanisi* (Jeffreys, 1869) – Landau *et al*., p. 40, pl. 22, fig. 11.

2011 *Chrysallida stefanisi* (Jeffreys, 1869) – Hernández *et al*., p. 251, figs 87C-D.

2013 *Chrysallida stefanisi* (Jeffreys, 1869) – Bellagamba *et al*., p. 120, fig. 2H-I.

2014 *Kongsrudia stefanisi* (Jeffreys, 1869) – Giannuzzi-Savelli *et al*., p. 62, fig. 152, appendix p. 18, 65.

non 1878 *Rissoa Stefanisi* Jeffr. – Nyst, pl. 28, fig 10 [= *P. jeffreysi* (Bell, 1871)].

non 1882 *Rissoa Stefanisi* Jeffr. – Nyst, p. 96 [= *P. jeffreysi* (Bell, 1871)].

non 1997 *Chrysallida stefanisi* (Jeffreys, 1869) – Marquet, p. 105, pl. 9, fig. 12 [= *P. jeffreysi* (Bell, 1871)].

non 1998 *Chrysallida stefanisi* (Jeffreys, 1869) – Marquet, p. 191, fig. 163 [= *P. jeffreysi* (Bell, 1871)].

?*non* 2014 *Pyrgulina stefanisi* (Jeffreys, 1869) – Peñas *et al*., p. 122, fig. 5H [specimen closer to *P. jeffreysi* (Bell, 1871)].

non 2018 *Pyrgulina stefanisi* (Jeffreys, 1869) – Ceulemans *et al*., p. 132, pl. 8, fig. 6 [= *P. jeffreysi* (Bell, 1871)].

Material and dimensions – Maximum height 3.3 mm, width 1.8 mm. **CO**: NHMW 2019/0167/0474 (1). **VC**: NHMW 2019/0167/0809 (5). **VS**: NHMW 2019/0167/0475 (1). **EL**: NHMW 2019/0167/0560-561 (2), NHMW 2019/0167/0562 (29).

Discussion – *Pyrgulina stefanisi* (Jeffreys, 1869) is characterised by its conical scalate spire, type C protoconch, up to five 'barrel-shaped' weakly convex whorls, separated by a deeply impressed suture, sculpture of 20-22 straight, rounded, orthocline ribs, narrower than their interspaces, overrun by 10-12 weaker spiral cords separated by narrow interspaces, last whorl about half total height, straight-sided to periphery, rounded at base, narrow umbilical chink, the axials persisting onto the base, and a weak columellar fold. This species is quite variable, especially in height; with some unusually tall shells present (Pl. 82, fig. 4).

Some authors have considered *Rissoa stefanisi* Jeffreys, 1869 and *Menestho jeffreysi* Bell, 1871 separate species (Harmer, 1920; Glibert, 1952; Chirli & Micali, 2011), whilst others considered them a single taxon (Van der Linden & Eikenboom, 1992). Others have adopted an even wider species concept and included the Miocene fossil species into synonymy (Peñas & Rolán, 1998)

Rissoa stefanisi was described by Jeffreys based on a specimen in the collection of De Stefanis, collected from Sicily. Therefore the type locality of this species is Sicily. *Menestho jeffreysi* was described by Bell based on one of two Pliocene shells from the Coralline Crag of England, described as *Rissoa costulata* by Wood (1848, pl. 11, fig. 12b). We have tried to revisit material from the type localities, but have been unable to find material from the Pliocene of England to compare. Extant specimens from the Tuscan Archipelago, Sicily and Croatia (*i.e*., considered to represent *P. stefanisi*) were compared to illustrations of fossil *P. jeffreysi*. *Pyrgulina stefanisi* has a more elevated protoconch,

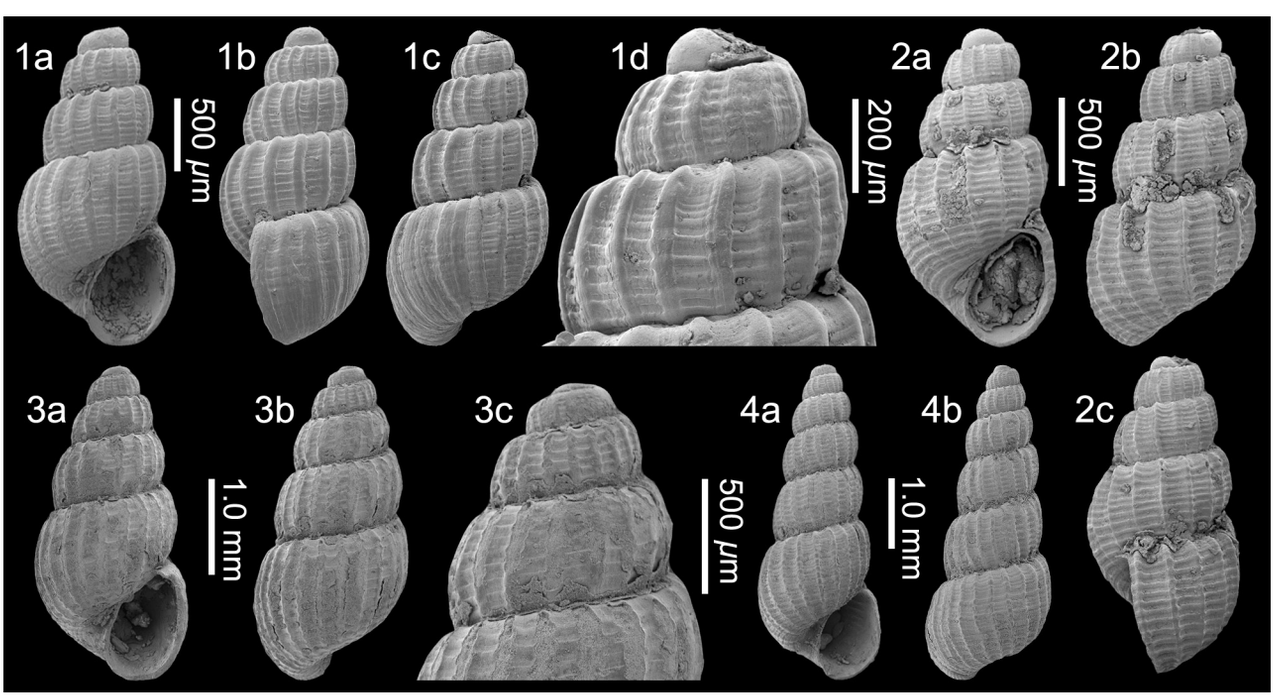

Plate 82. *Pyrgulina stefanisi* (Jeffreys, 1869); 1. NHMW 2019/0167/0560, height 2.1 mm, width 1.0 mm, 1d, detail of protoconch; 2. NHMW 2019/0167/0561, height 1.8 mm, width 0.9 mm. El Lobillo. 3. NHMW 2019/0167/0474, height 3.3 mm, width 1.6 mm, 3c, detail of protoconch. Velerín conglomerates. 4. NHMW 2019/0167/0475, height 4.4 mm, width 1.6 mm (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

about same number of spiral cords (12-18), but narrower and finer, separate by wider interspaces, and reaches a maximum height of about 2.2 mm, against over 4 mm for *P. jeffreysi*. On the other hand, in our opinion, the specimen named *P. stefanisi* from Mauritania figured in Peñas *et al*. (2014, fig. 5H), has somewhat different spiral sculpture composed of fewer flatter cords, and a depressed (type C) protoconch, indeed, more like the fossil *P. jeffreysi*. Based on spiral sculpture, *P. stefanisi* is more similar to the Miocene *P. parvula* (Nyst, 1845) than to *P. jeffreysi*. *Pyrgulina parvula* (Nyst, 1845) [= *Pyrgulina longula* (Boettger, 1907); = *Chrysallida interita* Van der Linden & Eikenboom, 1992; see Landau *et al*., 2020, p. 321], differs from *P. jeffreysi* in having flatter whorls, a more scalate spire, more elevated ribs, finer and more numerous spiral cords. *Pyrgulina parvula* was widely present in the Mediterranean Pliocene (Crovato & Micali, 1992a) together with *P. jeffreysi*. The two specimens figured by Cavallo & Repetto (1992, fig. 427) as *Chrysallida stefanisi* seem to correspond to these two species. Another member of this group is *P. mutata* Dautzenberg (*in* Lamy), 1913 from present-day West Africa (see Peñas & Rolán, 1998, p. 26, figs 73-78), which is remarkably similar to the Italian fossil specimen illustrated by Chirli & Micali (2011, pl. 12, figs 1-5) as *Chrysallida jeffreysii*. In their discussion, Peñas & Rolán considered the West African species to differ from *P. jeffreysi* in having more numerous and finer ribs, but stressed the great similarity between the two highlighted earlier by Crovato & Micali (1992a). The Estepona specimens can be referred to as *P. stefanisi* based on the narrow spiral cords, although the protoconch is more intorted (flatter) than seen in extant specimens.

It is possible that present-day *P. stefanisi* is the descendant, now much smaller and less frequent of *P. parvula*, while *P. jeffreysi* entered the Mediterranean during Pliocene and disappeared at the end of this period, or is now distributed further south along the coast of West Africa by its decendent/synonym *P. mutata*. Either way, it is likely that these specimens represent a species-complex rather than a single variable species.

Giannuzzi-Savelli *et al*. (2014) placed this species in the West African genus *Kongsrudia* Lygre & Schander, 2010, highlighting the "*undoubted morphological affinity*" between "*Chrysallida stefanisi*" and the type species of *Kongsrudia*, *Acteopyramis gruveli* Dautzenberg, 1910. *Kongsrudia* species are very tall turriform in profile with much stronger axial and spiral sculpture (see Lygre & Schander, 2010) and we fail to see the similarity. For further discussion see Landau *et al*. (2013, p. 313; 2020, p. 321).

Distribution – Lower Pliocene: Atlantic, Guadalquivir Basin, Spain (Ruiz Muñoz *et al*., 1997; Landau *et al*., 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992; Crovato & Micali, 1992b; Sosso & Dell'Angelo, 2010; Bellagamba *et al*., 2013). Lower Pleistocene: central Mediterranean, Italy (Di Geronimo *et al*., 1982; Di Geronimo & La Perna, 1997). Present-day: Mediterranean, Azores and Canaries (Van der Linden & Eikenboom, 1992; Cachia *et al*., 2001; Hernández *et al*., 2011; Giannuzzi-Savelli *et al*., 2014), West Africa to Ghana (Peñas & Rolán, 1998; Van Aartsen *et al*., 2000).

***Pyrgulina vanderlindeni* (Van Aartsen, Gittenberger & Goud, 2000)**

Plate 83, fig. 1

*2000	*Chrysallida* (*Pyrgulina*) *vanderlindeni* Van Aartsen, Gittenberger & Goud, p. 39, figs 47, 64.
2005	*Chrysallida vanderlindeni* Van Aartsen, Gittenberger & Goud, 2000 – Rolán, p. 192, fig. 893.

Material and dimensions – Height 2.9 mm, width 1.2 mm. **EL**: NHMW 2019/0167/0808 (1).

Discussion – *Pyrgulina vanderlindeni* (Van Aartsen, Gittenberger & Goud, 2000) is characterised by its apically truncated conical shell, type C protoconch, teleoconch of 4-4.5 convex whorls separated by a narrowly incised suture, sculptured by 20-25 narrow, orthocline, inverted S-shape ribs, about half the width of their interspaces that persist onto the base. The ribs are crossed by about ten very narrow spirals, becoming wider spaced and stronger towards the abapical suture. The last whorl is rounded at the base, umbilicus reduced to very small chink, aperture pyriform, with thin columellar callus, and no columellar fold. Van Aartsen *et al.* (2000, p. 39) compared their species to *P. eximia* (Jeffreys, 1849), but that species has only two spirals on the teleoconch whorls. This is the first fossil record for *P. vanderlindeni*, which today occurs only around the Cape Verde Islands (Rolán, 2005, p. 192).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Cape Verde Islands (Van Aartsen *et al*., 2000; Rolán, 2005).

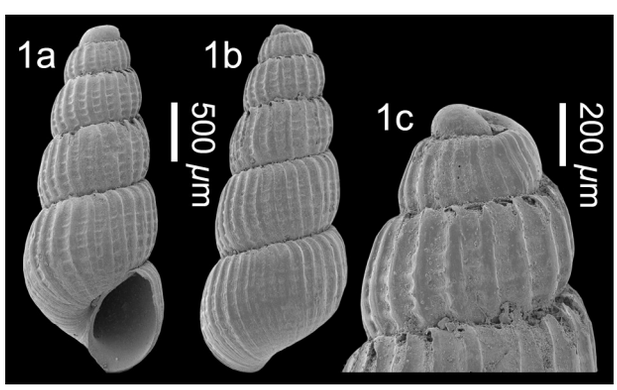

Plate 83. *Pyrgulina vanderlindeni* (Van Aartsen, Gittenberger & Goud, 2000); 1. NHMW 2019/0167/0808, height 2.9 mm, width 1.2 mm, 1c, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Genus *Spiralina* Chaster, 1898

Type species (by monotypy) – *Turbo spiralis* Montagu, 1803, *non* Poiret, 1801 [Planorbidae?] = *Voluta pellucida* Dillwyn, 1817, present-day, British Isles.

1898 *Spiralina* Chaster, p. 20. Neave (1940, vol. 4, p. 258) uncritically lists two senior homonyms of *Spiralina*, but both are unavailable: *Spiralina* Hartmann, 1840 is a *nomen nudum* (*fide* Hannibal, 1912, p. 153 until made available as subgenus of *Planorbis* by Martens, 1899, p. 395; *Spiralina* Brown, 1844 (p. 145, errata), and Gümbel, 1862 (p. 232) are invalid, as subsequent misspellings of *Spriolina* Lamarck, 1804 (pers. comm. Patrick LaFollette, 26/08/2021; BL).

1917 *Partulida* Schaufuss, p. 6. *Nomen nudum* from 1869 (see Corgan, 1973). Made available by Iredale (1917, p. 325) by designation of type. Type species (by subsequent designation): *Turbo spiralis* Montagu, 1803, present-day, British Isles. Junior objective synonym of *Spiralina* Chaster, 1898.

1901 *Spiralinella* Chaster, p. 8. Type species (by typification of replaced name): *Turbo spiralis* Montagu, 1803, present-day, British Isles.

Note – We are grateful to Patrick LaFollette for pointing out that the correct name for this genus is *Spiralina* Chaster, 1898 and not the genus in current use *Spiralella* Chaster, 1901 (Poggiani & Micali,, 2018; Landau *et al*., 2020; *inter alia*); see above.
Spiralina species are characterised by species with prominent ribs sharply interrupted at the periphery by strong spiral cords that continue over the base (Giannuzzi-Savelli *et al*., 2014; p. 71; under *Partulida*, which is unavailable; see above). Based on molecular data, Schander *et al*. (2003, fig. 2) suggested that *Spiralina* appeared to be monophyletic.

***Spiralina alpinoligustica* (Sacco, 1892)**
Plate 84, figs 1-6

1869 *Odostomia turbonilloides* Brusina, p. 240 (*non* Deshayes, 1861).

*1892a *Pyrgulina turbonilloides* var. *alpinoligustica* Sacco, p. 67, pl. 1, fig. 110.

1914 *Parthenina spiralis* var. *convexula* Cerulli-Irelli, p. 265 [439], pl. 23 [55], fig. 14.

1916 *Parthenina incerta* Milaschewitsch, p. 98.

1921 *Pyrgulina Brusinai* Cossmann, p. 258. *Nom. nov. pro Odostomia turbonilloides* Brusina, 1869 *non* Deshayes, 1861.

1933 *Pyrgulina coëni* Monterosato ms Coen, p. 52, 164, pl. 4, fig. 37.

1933 *Pyrgulina brevicula* var. *rejecta* Coen, p. 54, 165, pl. 4, fig. 39.

1972b *Chrysallida* (*Partidula*) *incerta* (Milaschewitsch, 1916) – Nordsieck, p. 100, pl. PII, fig. 11.

1977 *Chrysallida turbonilloides* (Brus.) – Van Aartsen, p. 53, 58, pl. 1, fig. 7.

1984 *Pyrgulina turbonilloides* var. *alpinoligustica* Sacco, 1892 – Ferrero Mortara *et al*., p. 79, pl. 10, fig. 8.

1992 *Chrysallida brusinai* (Cossmann, 1921) – Van der Linden & Eikenboom, p. 11, fig. 20.

1996 *Chrysallida brusinai* (Cossmann, 1921) – Peñas *et al*., p. 15, figs 13-14.

1998 *Chrysallida brusinai* (Cossmann, 1921) – Peñas & Rolán, p. 36, figs 102-103.

1998 *Chrysallida incerta* (Milaschewitsch, 1916) – Wilke & Van Aartsen, p. 10, pl. 3, fig. 18a-c.

2004 *Chrysallida incerta* (Milaschewitsch, 1916) – Bogi & Chirli, p. 91, fig. 1o.

2004 *Chrysallida incerta* (Milaschewitsch, 1916) – Poggiani *et al*., p. 82, unnumbered fig.

2011 *Chrysallida incerta* (Milaschewitsch, 1916) – Chirli & Micali, p. 32, pl. 10, figs 6-10.

2011 *Chrysallida incerta* (Milaschewitsch, 1916) – Öztürk *et al*., p. 62, fig 9A-C.

2011 *Chrysallida incerta* (Milaschew., 1916) – Chirli & Linse, p. 196, pl. 73, fig. 3.

2011 *Chrysallida incerta* (Milaschewitsch, 1916) – Cossignani & Ardovini, p. 347, unnumbered fig.

2011 *Chrysallida brusinai* (Cossmann, 1921) – Hernández *et al*., p. 247, figs 85A-C.

2014 *Parthenina incerta* Milaschewitsch, 1916 – Peñas *et al*., p. 110, figs 1H-I.

2014 *Partulida incerta* (Milaschewitsch, 1916) – Giannuzzi-Savelli *et al*., p. 72, figs 203-211, appendix p. 23, 71.

2018 *Spiralinella incerta* (Milaschewitsch, 1916) – Poggiani & Micali, p. 221, fig. 2.

2018 *Parthenina incerta* Milaschewitsch, 1916 – Trigo *et al*., p. 361, fig. 6.

2020 *Spiralinella incerta* (Milaschewitsch, 1916) – Landau *et al*., p. 323, pl. 51, fig. 1.

non 2018 *Chrysallida incerta* (Milaschewitsch, 1916) – Brunetti & Cresti, p. 104, fig. 447 (= *Chrysallida craticulata* De Stefani & Pantanelli, 1878).

Material and dimensions – Maximum height 2.4 mm, width 925 μm. **CO**: NHMW 2019/0167/0274 (2). **VA**: NHMW 2019/0167/0293-0295 (3). **VS**: NHMW 2019/0167/0439 (1). **EL**: NHMW 2019/0167/0633 (50+); NHMW 2019/0167/0736-0737 (2).

Discussion – *Spiralina alpinoligustica* (Sacco, 1892) is characterised by its conical shell with blunt apex, type C protoconch, up to five almost straight sided teleoconch whorls separated by a canaliculated suture, with 20-25 orthocline to slightly prosocline strong rounded ribs ending abruptly at a robust cord placed just above the suture. On the last whorl a further robust cord runs at the level of the insertion of the outer lip, separated from the adapically placed robust cord by a deep narrow interspace, and four to five further cords weakening over the base.
This species is usually recorded in the literature as *Chrysallida* or *Spiralinella incerta* (Milaschewitsch, 1916).

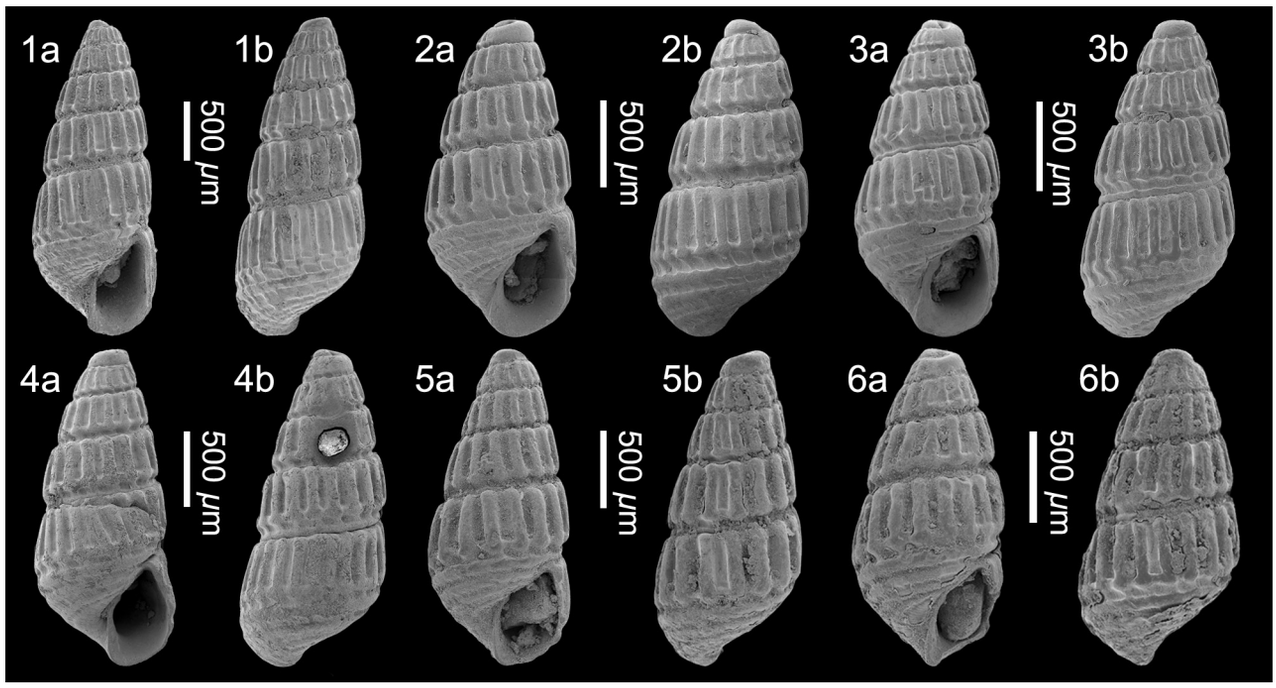

Plate 84. *Spiralina alpinoligustica* (Sacco, 1892); 1. NHMW 2019/0167/0293, height 2.4 mm, width 925 μm. Velerín conglomerates. 2. NHMW 2019/0167/0439, height 1.8 mm, width 840 μm. Velerín sands, Velerín. 3. NHMW 2019/0167/0736, height 1.8 mm, width 800 μm; 4. NHMW 2019/0167/0737, height 2.1 mm, width 920 μm El Lobillo. 5. 2019/0167/0294, height 2.0 mm, width 905 μm; 6. 2019/0167/0294, height 1.9 mm, width 885 μm (SEM images). Velerín sands, Estepona, lower Piacenzian, upper Pliocene.

A detailed revision of the fossil literature has revealed two possible senior synonyms of Milaschewitch's name; *Pyrgulina turbonilloides* var. *alpinoligustica* Sacco, 1892 and *Parthenina spiralis* var. *convexula* Cerulli-Irelli, 1914. It would be preferable to maintain nomenclatural stability and retain Milaschewitch's name as *nomen protectum*. However, Sacco's name has subsequently been used since 1899 by several authors (Martinelli, 1907, p. 217; Cossmann & Peyrot, 1917, p. 131; Cossmann, 1921, p. 242; Gougerot, 1969, p. 131; and Ferrero Mortara *et al*., 1984: 79, pl. 10, fig. 8), and we can therefore not apply Article 23.9.1.2 (ICZN Code, 1999) (pers. comm. Patrick LaFollette, 9/18/2021). We can find no record of the use of *Parthenina spiralis* var. *convexula* Cerulli-Irelli,1914 after its original publication, but since that was published after 1899, it cannot be suppressed either. It is, in any case, a junior subjective synonym of *alpinoligustica*.
The species from the upper Pliocene of Italy illustrated by Brunetti & Cresti (2018, fig. 447) as *Chrysallida incerta* has spiral sculpture above the strong abapical cord and probably does not represent this species, but *Chrysallida craticulata* De Stefani & Pantanelli, 1878, which is best placed in the genus *Chrysallida* Carpenter, 1856.

Distribution – Upper Miocene (Tortonian): Atlantic, NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984; Crovato & Micali, 1993; Bogi & Chirli, 2004; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Crovato & Micali, 1993; Ragaini & Bernieri, 2007). Lower Pleistocene: central Mediterranean, Italy (Crovato & Micali, 1992a); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: central Mediterranean, Italy (Crovato & Micali, 1992a). Present-day: Atlantic, northwestern Spain (Trigo *et al*., 2018), south Portugal to Canaries (Hernández *et al*., 2011), West Africa, Angola (Peñas & Rolán, 1998; Van Aartsen *et al*., 2000; Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011), Black Sea (Nordsieck, 1972b; Wilke & Van Aartsen, 1998).

Genus *Trabecula* Monterosato, 1884

Type species – Trabecula jeffreysiana Monterosato, 1884, by monotypy, present-day, Mediterranean.

1884 *Trabecula* Monterosato, p. 86.
1909 *Salassiella* Dall & Bartsch, p. 133. Type species (by original designation): *Odostomia* (*Salassiella*) *laxa* Dall & Bartsch, 1909, present-day, Baja California, Pacific Mexico.

Note – This genus is characterised by having species with strong axial ribs extending between the sutures, spiral sculpture is absent, the base is not sharply delimited, an ovate aperture, and no columellar fold. In their key to pyramidellid genera Dall & Bartsch (1904, p. 10; 1909, p. 13) characterised the genus as "*intercostal spaces crossed*

by equally spaced, raised spiral threads, sculpture reticulated". However, the type species *Trabecula jeffreysiana* Monterosato, 1884 has no spiral sculpture. In most pyramidellid genera the presence or absence of spiral sculpture is considered a generic character. The tropical American genus *Salassiella* Dall & Bartsch, 1903, originally proposed as a subgenus of *Odostomia*, is herein considered a synonym. The sculpture of the Californian and Caribbean species is a little more irregular than in *T. jeffreysiana,* but otherwise they are similar in size and sculpture.

***Trabecula jeffreysiana* Monterosato, 1884**
Plate 85, figs 1-2

*1884	*Trabecula Jeffreysiana* Monterosato, p. 86.
1897	*Odostomia* (*Turbonilla*) *undata* Watson, p. 262, pl. 20, fig. 31.
1912	*Odostomia Seguenzai* Pallary, p. 196, pl. 16, fig. 24.
1972b	*Chrysallida* (*Trabecula*) *jeffreysiana* (Monterosato, 1884) – Nordsieck, p. 97, pl. PII, fig. 1.
1977	*Chrysallida jeffreysiana* (Mtrs.) – Van Aartsen, p. 50, 58, pl. 1, fig. 2.
1992	*Chrysallida jeffreysiana* (Monterosato, 1884) – Van der Linden & Eikenboom, p. 8, figs 16, 17.
1996	*Odostomella jeffreysiana* (Monterosato, 1884) – Peñas *et al*., p. 31, fig. 10.
2001	*Chrysallida jeffreysiana* (Monterosato, 1884) – Cachia *et al*., p. 89, pl. 14, fig. 2.
2008	*Chrysallida jeffreysiana* (Monterosato, 1884) – Chirli & Micali, p. 42, figs 1I, L.
2011	*Chrysallida jeffreysiana* (Monterosato, 1884) – Öztürk *et al*., p. 65, fig. 12.
2011	*Chrysallida jeffreysiana* (Monterosato, 1884) – Chirli & Linse, p. 197, pl. 74, fig. 2.
2011	*Chrysallida jeffreysiana* (Monterosato, 1884) – Chirli & Micali, p. 38, pl. 11, figs 11-15.
2011	*Odostomella jeffreysiana* (Monterosato, 1884) – Hernández *et al*., p. 253, figs 87L-N.
2014	*Trabecula jeffreysiana* (Monterosato, 1884) – Giannuzzi-Savelli *et al*., p. 74, figs 224-227, appendix p. 25, 73.
2014	*Trabecula jeffreysiana* Monterosato, 1884 – Peñas *et al*., p. 132, figs 9G-I.

Material and dimensions – Maximum height 3.9 mm, width 1.3 mm. **CO**: NHMW 2019/0167/0403 (1), NHMW 2019/0167/0404 (1). **EL**: 2019/0167/0637 (2).

Discussion – *Trabecula jeffreysiana* Monterosato, 1884 is characterised by its elongated profile, type B protoconch, teleoconch of 4-5 convex whorls, separated by a deeply impressed undulating suture, 20-25 orthocline ribs, equal in width to slightly wider than their interspaces, absence of spiral sculpture, last whorl about half total height, the ribs weakening towards the base, the base is poorly delimited, smooth, imperforate, the outer lip is convex and slightly thickened, and the columella is oblique, devoid of a fold.
This is the only extant eastern Atlantic/Mediterranean member of the genus. The West African species included by Van Aartsen *et al*. (2000) in the genus/subgenus, *Crysallida* (*Trabecula*) *kronenbergi* (Van Aartsen, Gittenberger & Goud, 2000) has spiral sculpture and, in our opinion should be placed in *Parthenina*. *Trabecula* is represented in the Pliocene and present day western Atlantic by *Trabecula balchi* (Bartsch, 1955) [= *Trabecula krumpermani* (De Jong & Coomans, 1988)] and and in the eastern Pacific by *Trabecula laxa* (Dall & Bartsch, 1909). As far as we are aware, there are no European fossil congeners with which to compare this species.

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992a; Chirli & Micali, 2008, 2014). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Upper Pleistocene: central Mediterranean; Sardinia (Di Geronimo & Li Gioi, 1981), eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: eastern Atlantic Canaries (Nordsieck, 1972b; Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), Cape Verde Islands, West Africa, Mauritania, Ivory Coast to Congo (Van Aartsen *et al*., 2000; Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972a; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*.,

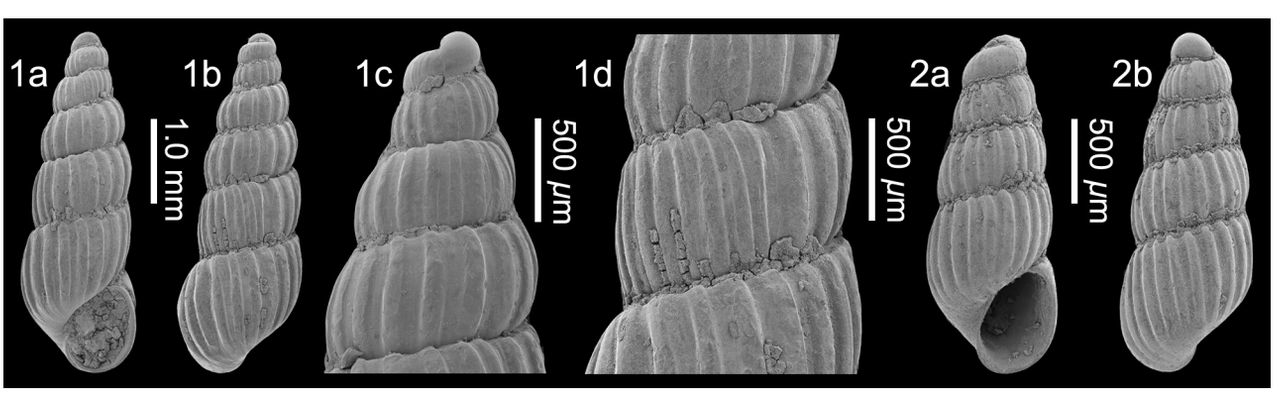

Plate 85. *Trabecula jeffreysiana* Monterosato, 1884; 1. NHMW 2019/0167/0403, height 3.9 mm, width 1.3 mm, 1c, detail of protoconch. 1d, detail of teleoconch sculpture; 2. NHMW 2019/0167/0404 (subadult), height 2.0 mm, width 740 μm (SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011).

Genus *Tragula* Monterosato, 1884

Type species – *Odostomia fenestrata* Jeffreys, 1848, by original designation, present-day, British Isles.

1884 *Tragula* Monterosato, p. 86.
1915 *Burkillia* Iredale, p. 337. Type species (by original designation): *Odostomia fenestrata* Jeffreys, 1848, present-day, British Isles. Unnecessary *nom. nov. pro Tragula* Monterosato, 1884 by Iredale, assumed to be preoccupied by *Tragulus* Brisson, 1762 [Mammalia].

***Tragula fenestrata* (Jeffreys, 1848)**
Plate 86, fig. 1

*1848 *Odostomia fenestrata* Jeffreys, p. 345.
1892a *Pyrgulina* (*Tragula*) *fenestrata* var. *subalpina* Sacco, p. 69, pl. 1, fig. 114.
1914 *Parthenina* (*Tragula*) *fenestrata* Forbes – Cerulli Irelli, p. 266 [440], pl. 23 [55], figs 18, 19.
1921 *Tragula fenestrata* (Forbes) – Cossmann, p. 262, text-plate C, fig. 90fc.
1969 *Pyrgulina* (*Tragula*) *fenestrata* (Forbs) – Fekih, p. 26, pl. 4, fig. 4.
1972b *Turbonilla* (*Tragula*) *fenestrata* (Forbes, 1848) – Nordsieck, p. 132, pl. PVI, fig. 17.
1981 *Chrysallida fenestrata* (Forbes in Jeffreys, 1848) – Van Aartsen, p. 63, 65, pl. 1, fig. 1.
1984 *Tragula fenestrata* var. *subalpina* Sacco, 1892 – Ferrero Mortara *et al*., p. 79, pl. 12, fig. 5.
1984 *Chrysallida fenestrata* (Jeffreys, 1848) – Chirli, p. 25, fig. 4.
1986 *Tragula fenestrata* (Jeffreys, 1848) – Fretter *et al*., p. 578, figs 392, 393.
1988 *Tragula fenestrata* (Jeffreys, 1848) – Graham, p. 564, fig. 243.
1992 *Tragula fenestrata* (Jeffreys, 1848) – Cavallo & Repetto, p. 154, fig. 432.
1992 *Chrysallida fenestrata* (Jeffreys, 1848) – Van der Linden & Eikenboom, p. 48, fig. 57.
1996 *Chrysallida fenestrata* (Jeffreys, 1848) – Peñas *et al*., p. 18, fig. 54.
1998 *Chrysallida fenestrata* (Jeffreys, 1848) – Peñas & Rolán, p. 14, figs 38-42.
1998 *Chrysallida fenestrata* (Jeffreys, 1848) – Wilke & Van Aartsen, p. 9, pl. 2, fig. 17a, b.
2001 *Tragula fenestrata* (Jeffreys, 1848) – Cachia *et al*., p. 93, pl. 15, fig. 2.
2010 *Tragula fenestrata* (Jeffreys, 1848) – Sosso & Dell'Angelo, p. 52, p. 67 unnumbered fig. middle row second from left.
2011 *Chrysallida fenestrata* (Jeffreys, 1848) – Chirli & Micali, p. 27, pl. 8, figs 11-15.
2011 *Chrysallida fenestrata* (Jeffreys, 1848) – Öztürk *et al*., p. 60, fig 7A-E.
2011 *Chrysallida fenestrata* (Jeffreys, 1848) – Chirli & Linse, p. 195, pl. 73, fig. 1.
2011 *Chrysallida fenestrata* (Jeffreys, 1848) – Hernández *et al*., p. 249, figs 86A-C.
2014 *Tragula fenestrata* (Jeffreys, 1848) – Giannuzzi-Savelli *et al*., p. 76, figs 228-230, appendix p. 25, 73.
2014 *Tragula fenestrata* (Jeffreys, 1848) – Peñas *et al*., p. 126, fig. 7C.
2018 *Tragula fenestrata* (Jeffreys, 1848) – Ceulemans *et al*., p. 133, pl. 8, fig 7.
2018 *Chrysallida fenestrata* (Jeffreys, 1848) – Trigo *et al*., p. 361, fig. 2.
2020 *Tragula fenestrata* (Jeffreys, 1848) – Landau *et al*., p. 324, pl. 52, fig. 1.

Material and dimensions – Maximum height 3.8 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0077 (1). **EL**: NHMW 2019/0167/0551 (6).

Discussion – *Tragula fenestrata* (Jeffreys, 1848) is characterised by its very elongate slender shell, its intorted protoconch of type B, tending to A1. The shell has 5-7 teleoconch whorls, in which the upper two-thirds of the whorl are straight-sided and the lower third is convex, the lower part bearing two spiral cords on spire whorls and three on the last whorl. Peñas & Rolán (1998, p. 15)

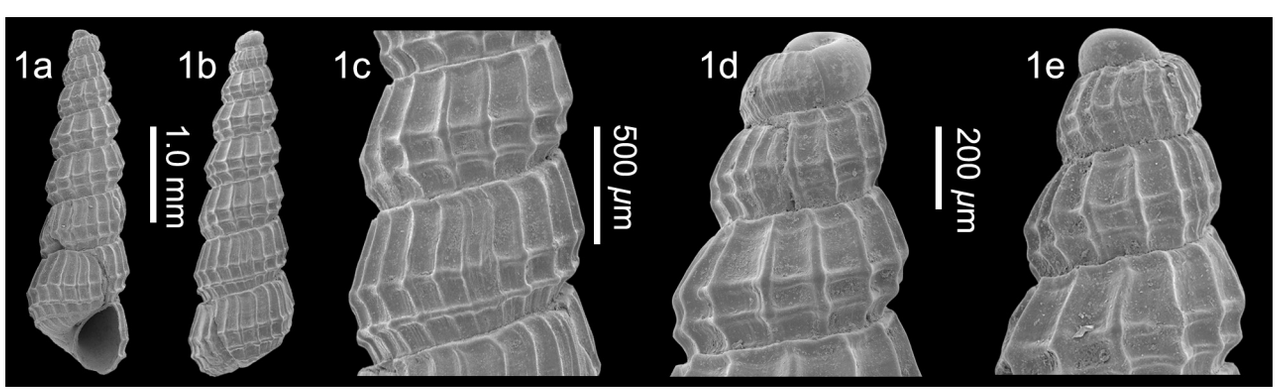

Plate 86. *Tragula fenestrata* (Jeffreys, 1848); 1. NHMW 2019/0167/0077, height 3.8 mm, width 1.2 mm, 1c, detail of teleoconch sculpture, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

reported some variability: the West Africa shells having a larger protoconch, a more cylindrical teleoconch composed of more convex whorls, a less angular base and weak spiral sculpture on the adapical part of the whorls. The specimens from Estepona fit within the range of variability for extant Mediterranean specimens illustrated by Giannuzzi-Savelli *et al*. (2014, fig. 229) from Turkey. Italian Pliocene specimens illustrated by Chirli & Micali (2011, pl. 8, figs 11-15) are very tall and slender with a strongly oblique suture and more angular whorls than the Estepona specimen illustrated above, and similar to the extant Mediterranean specimen illustrated by Giannuzzi-Savelli *et al*. (2014, fig. 228). Therefore, some variability was also present in the Pliocene Mediterranean.
Tragula interstinctoides Sacco, 1892 (holotype figured by Ferrero Mortara *et al*., 1984, pl. 12, fig. 2; specimen also figured by Brunetti & Cresti, 2018, fig. 459), also from the Italian Pliocene, differs from *T. fenestrata* in being slenderer, the outline of the early teleococonch whorls is more cylindrical, and the whorl profile is less convex. The holotype is poorly preserved, making clear characterisation difficult; the two species are very similar and *T. interstinctoides* could be a Pliocene offshoot. For comparison with *T. saccoi* Bongiardino & Micali, 2018, see below.

Distribution – Upper Miocene (Tortonian): Atlantic, NW France (Landau *et al*., 2020). Lower Pliocene: Atlantic, NW France (Ceulemans *et al*., 2018); central Mediterranean, Italy (Chirli, 1984; Crovato & Micali, 1992a; Chirli & Micali, 2011); western Mediterranean, Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992; Crovato & Micali, 1992a; Sosso & Dell'Angelo, 2010). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Brunetti, 2011). Upper Pleistocene: eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic southwest of England and western Ireland (Nordsieck, 1972b; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), southwards to Canaries (Hernández *et al*., 2011), West Africa, Angola (Peñas & Rolán, 1998; Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014; Peñas & Rolán, 1998), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk *et al*., 2011), Black Sea (Nordsieck, 1972b; Wilke & Van Aartsen, 1998).

Tragula saccoi Bongiardino & Micali, 2018

Plate 87, figs 1-2

2018 *Tragula* sp. – Brunetti & Cresti, p. 106, fig. 460.
*2018 *Tragula saccoi* Bongiardino & Micali, p. 102, figs 1D, E.

Material and dimensions – Maximum height 3.0 mm, width 1.1 mm. **CO**: NHMW 2019/0167/0827 (1). **VC**: NHMW 2019/0167/0099 (1), NHMW 2019/0167/0100 (29), NHMW 2019/0167/0545 (1). **EL**: 2019/0167/0636 (2).

Discussion – *Tragula saccoi* Bongiardino & Micali, 2018 is characterised by its tall pagodiform shell, type C protoconch, spire whorls somewhat angular mid-whorl, separated by a deep V-shaped suture, 16-19 narrow, orthocline to prosocline, slightly sinuous axial ribs, four narrow spiral cords that do not cross ribs; adapical and mid-whorl cord slightly stronger, adapical cord somewhat coronate, second cord weakest, third cord delimiting whorl periphery, abapical cord intermediate strength. Small tubercles are developed at the sculptural intersections. The aperture is small, the columellar evenly excavated, without a fold. *Tragula fenestrata* (Jeffreys, 1848) from the European upper Miocene to present day differs in having a more clearly pagodiform profile, with a less depressed protoconch and only two spiral cords placed abapically. *Tragula interstinctoides* (Sacco, 1892) from the Mediterranean Pliocene is more similar to *T. fenestrata* (see above for comparison).

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018; Bongiardino & Micali, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Bongiardino & Micali, 2018).

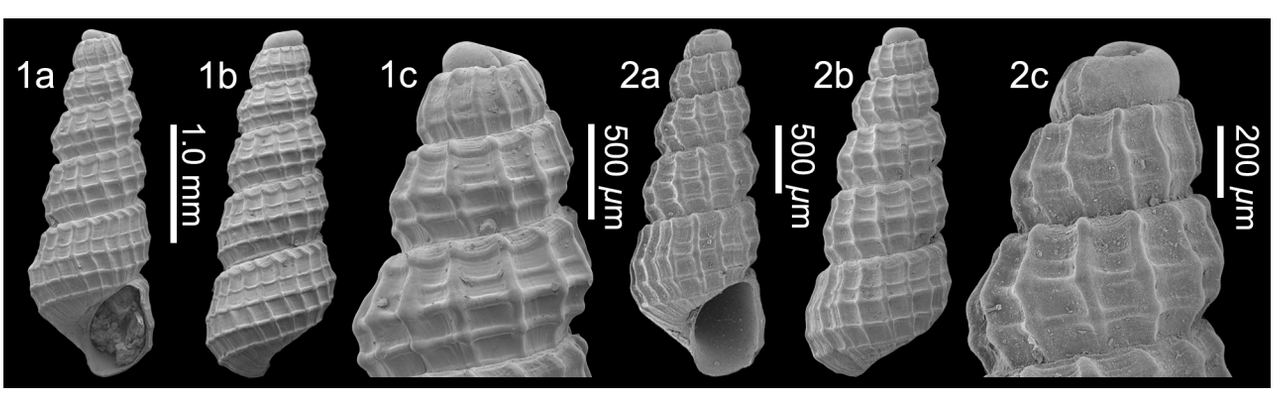

Plate 87. *Tragula saccoi* Bongiardino & Micali, 2018; 1. **NHMW 2019/0167/0099, height 3.0 mm, width 1.1 mm, 1c, detail of protoconch**; 2. NHMW 2019/0167/0545, height 2.6 mm, width 970 μm, 1c, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Subfamily Syrnolinae Saurin, 1958
Tribe Syrnolini Saurin, 1958
Genus *Puposyrnola* Cossmann, 1921

Type species – Auricula acicula Lamarck, 1804, by original designation, Eocene, France.

1921 *Puposyrnola* Cossmann, p. 229.
1938 *Hoonsyrnola* Nomura, p. 78. Type species (by original designation): *Syrnola inturbida* Yokoyama, 1927, Pleistocene, Japan.

Note – Puposyrnola Cossmann, 1921 includes species with a cyrtoconoid or pupaeform shell profile and strongly developed columella, and considered valid by recent authors (Robba, 2013; Giannuzzi-Savelli *et al*., 2014; Peñas & Rolán, 2016).

***Puposyrnola minuta* (H. Adams, 1869)**
Plate 88, figs 1-2

*1869 *Syrnola minuta* H. Adams, p. 274, pl. 19, fig. 10.
1873 *Odostomia macella* Brugnone, p. 8, fig. 9.
1972b *Syrnola* (*Puposyrnola*) *minuta* (H. Adams, 1869) – Nordsieck, p. 118, pl. PIV, fig. 27.
1977 *Syrnola minuta* H. Adams, 1869 – Carrozza, pl. 2, fig. 5.
1994 *Puposyrnola minuta* (H. Adams, 1869) – Van Aartsen, p. 93, fig. 10.
1996 *Puposyrnola minuta* (H. Adams, 1869) – Peñas *et al*., p. 38, figs 89-90, 93.
2001 *Puposyrnola minuta* (H. Adams, 1869) – Cachia *et al*., p. 94, pl. 15, fig. 3.
2013 *Puposyrnola minuta* (Adams, H., 1869) – Öztürk & Bitlis Bakir, p. 428, fig 11.
2014 *Puposyrnola minuta* (H. Adams, 1869) – Giannuzzi-Savelli *et al*., p. 90, fig. 310, appendix page 37, 84.

Material and dimensions – Maximum height 3.8 mm, width 1.1 mm. **VC**: NHMW 2019/0167/0193 (1), NHMW 2019/0167/0194 (1). **EL**: NHMW 2019/0167/0420 (1), NHMW 2019/0167/0421 (1).

Discussion – Puposyrnola minuta (H. Adams, 1869) is characterised by its small slender shell, strongly cyrtoconoid early teleoconch whorls, regularly cylindrical, straight-sided middle and late whorls, separated by a moderately impressed suture. Axial sculpture of folds or weak ribs are present in some specimens, absent in others; growth lines are prosocline. The columella is somewhat thickened and bears a well developed oblique fold. The protoconch is of type B (Estepona specimen; dp = 300 μm, hp = 245 μm), and seems slightly less intorted than that figured by Peñas *et al*. (1996, fig. 93) for the recent shell from eastern Spain. This is the only extant European *Puposyrnola* species.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brugnone, 1873; Seguenza, 1876; Crovato & Micali, 1992b). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Madeira (Nordsieck, 1972b), Canary Islands, West Africa, Mauritania (Nordsieck, 1972b; Van Aartsen *et al*., 1998; Peñas & Rolán, 1997), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Carrozza, 1977; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

Genus *Syrnola* A. Adams, 1860

Type species (by monotypy) – *Syrnola gracillima* A. Adams, 1860, present-day, Korea Strait.

1860b *Syrnola* A. Adams, p. 405.
1903 *Heida* Dall, p. 1600. Type species (by subsequent designation, Dall & Bartsch, 1904, p. 13) *Odontostomia (Syrnola) caloosaensis* Dall, 1892, Pliocene, North Carolina, USA.
1907 *Pachysyrnola* Cossmann, p. 213. Type species (by original designation): *Syrnola houdasi* Cossmann, 1907, Eocene, France.

Note – Species included in this genus have tall, slender shells, smooth, except for microscopic growth lines and

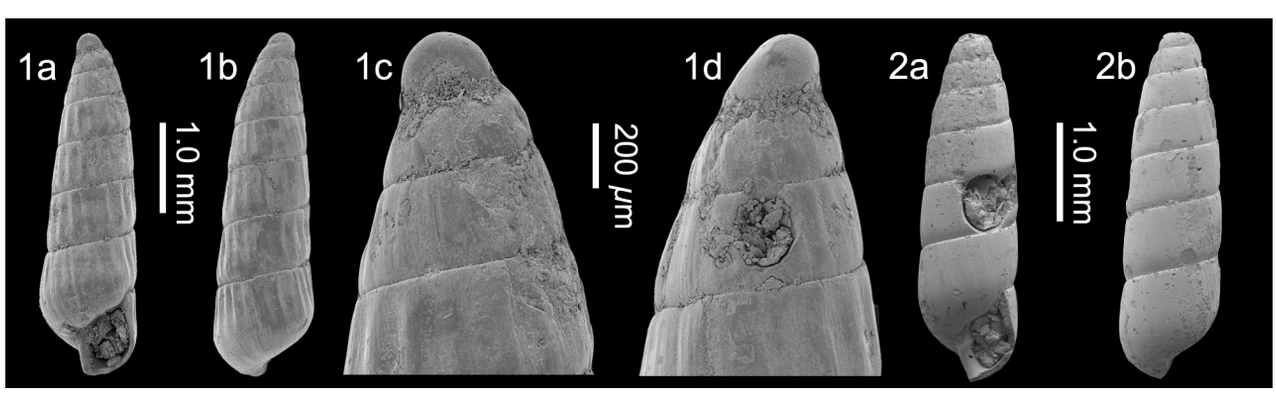

Plate 88. *Puposyrnola minuta* (H. Adams, 1869); 1. NHMW 2019/0167/0420, height 3.8 mm, width 1.1 mm, 1c-d, detail of protoconch. El Lobillo. 2. NHMW 2019/0167/0193, height 3.5 mm, width 1.0 mm, (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

an aperture with a conspicuous columellar fold (Peñas & Rolán, 2016, p. 218).

***Syrnola* sp.**
Plate 89, fig. 1

Material and dimensions – Height 11.3 mm, width 2.6 mm. **EL**: NHMW 2019/0167/0735 (1).

Description – Shell large, slender, early whorls with cyrtoconoid profile, later conical. Protoconch (poorly preserved) with type A tending to B (dp = 520 μm, tilted at angle of 120° to main shell axis). Teleoconch of 11 whorls, initially convex, later straight-sided, separated by moderately impressed suture. Growth lines straight, orthocline. Last whorl 29% total height, broadly rounded at base, base not depressed. Aperture small, columella short, bearing one well developed fold and weak second fold, abapical delimiting siphonal canal, adapical placed mid-columella.

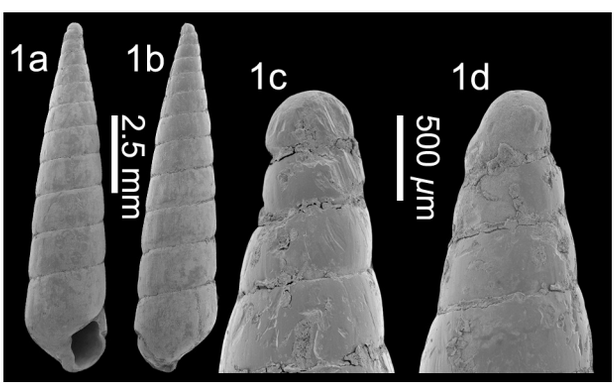

Plate 89. *Syrnola* sp.; 1. NHMW 2019/0167/0735, height 11.3 mm, width 2.6 mm, 1c-d, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Discussion – This species is represented by a single specimen. It has a well developed columellar fold and a second fold that might be a malformation. With the scant material available, we cannot be certain.
The 'West African' character of the Estepona assemblage is well illustrated in this work on the Pyramidellidae, with many extant West African species present in this tropical Pliocene Mediterranean fauna. The genus *Syrnola* A. Adams, 1860 is thermophilic, as no species occur in the present-day Mediterranean (Giannuzzi-Savelli *et al*., 2014), but it is fairly well represented further south in tropical West African waters by at least nine species (Peñas & Rolán, 1999, Peñas *et al*., 2014). It is therefore surprising that a single shell attributable to this genus was found in Estepona.

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

Subfamily Turbonillinae Bronn, 1849
Tribe Turbonillini Bronn, 1849

In the present work we recognise several genera within the tribe Turbonillini. The genera used are: *Chemnitzia* d'Orbigny, 1840, *Mormula* A. Adams, 1863, *Pyrgisculus* Monterosato, 1884, *Pyrgiscus* Philippi, 1841, *Pyrgolidium* Monterosato, 1884, *Pyrgostylus* Monterosato, 1884, *Strioturbonilla* Sacco, 1892 and *Turbonilla* Risso, 1826. In the absence of detailed molecular data, this splitting of "*Turbonilla sensu lato*" is based on the shell characters. The careful review of the historical references, present-day distributions, and the attempt herein to identify groups that are more likely to be monophyletic, gives a better insight into the palaeobiogeography of turbonillids in the European Neogene. Having said this, a generic revision of turbonillids was not the primary goal of this work, and the findings are subject to further study and especially a more detailed molecular phylogeny may reveal quite different insights.
The genus *Turbonilla* was first used for the late Cretaceous *T. coalvillensis* Meek, 1873 of Utah, USA. However, this species was transferred to the genus *Dircella* Sohl (1961, p. 47) (Potamididae). We are not certain of the first occurrence of Turbonillini. Today the tribe has a worldwide distribution, with a long history of diversification, speciation, adaptation to different habitats and hosts, but also of possible 'parallel evolution' and 'convergence' (Dubois, 1988).
For further discussion see under generic notes.

Genus *Chemnitzia* d'Orbigny, 1840

Type species – *Melania campanellae* Philippi, 1836 [= *Chemnitzia lactea* (Linnaeus, 1758)], by subsequent designation (Dall & Bartsch, 1909), present-day, Mediterranean.

1840 *Chemnitzia* d'Orbigny, p. 77.

Note – Species in this group are characterised by having prominent axial ribs, which terminate at the suture, deeply-sunken interspaces starting at the adapical suture and terminating at or just above the abapical suture, no spiral sculpture or microscopic spiral sculpture, a smooth base and a straight columella (Dall & Bartsch, 1909).
The character that most clearly separates *Chemnitzia* from *Turbonilla* is the presence of a well-defined basal disc. The basal disc is formed at the periphery of the last whorl and consists of a smooth, raised circular structure at which both the ribs and the axial interspaces end abruptly at a 'wall-like' edge. In *Chemnitzia* species, the raised edge, delimiting the basal disc, can usually also be seen to develop on the penultimate whorl, with the ribs ending abruptly at this suprasutural cord rather than extending to the suture. However, we have not observed this in the type species *Chemnitzia lactea* (Linnaeus, 1758). In many species the ribs gradually attenuate at the pe-

riphery, or the ribs extend a variable distance over the base, widening and progressively closing the axial interspaces below the periphery, but no clear disc is formed. This latter character is variable and not suitable as a generic determinant.

Italian Pliocene species discussed by Chirli & Micali (2011) which we consider to be placed in this genus are: *C. beidaensis* (Peñas & Rolán, 2000), *C. fiorenzae* (Chirli & Micali, 2011), *C. florentina* (Costa, 1861), *C. intuspersulcata* (Sacco, 1892), *C. lactea* (Linnaeus, 1758), *C. pliomagna* (Sacco, 1892), *C. plioperstricta* (Chirli & Micali, 2011), and *C. senegalensis* (Von Maltzan, 1885).

Present-day Mediterranean species discussed by Giannuzzi-Savelli *et al*. (2014) which we consider to belong in this genus, and not already listed above, are: *C. postacuticostata* (Sacco, 1892) and *C. sinuosa* (Jeffreys, 1884).

***Chemnitzia diezi* (Peñas & Rolán, 1997)**
Plate 90, fig. 1

1994 *Turbonilla melvilli* Dautzenberg, 1913 [*sic*] – Schander, pl. 7, fig. H, pl. 14, figs a-b (*non Turbonilla melvilli* Dautzenberg, 1912).
*1997 *Turbonilla diezi* Peñas & Rolán, p. 22, figs 37-38.

Material and dimensions – Maximum height 8.8 mm, width 2.0 mm. **CO**: NHMW 2019/0167/0410 (1), NHMW 2019/0167/0411 (1).

Discussion – This species is characterised by its tall, slender shell, type A2 protoconch with 2.5 whorls exposed (dp = 275 μm, hp = 275 μm, tilted at about 107° to main shell axis), teleoconch of 12 whorls, early whorls strongly convex, more straight-sided abapically, separated by a moderately impressed linear suture, sculpture of slightly sinuous, narrow, rounded, opisthocline ribs, slightly narrower than their interspaces, last whorl weakly convex, base somewhat flattened, the ribs terminating abruptly at the base, forming a weak basal disc, the aperture is subquadrate, and the columella vertical, without a fold. The protoconch of the Estepona specimen is almost identical in size to the holotype (dp = 275 μm, hp = 205 μm; measured from Peñas & Rolán, 1997, fig. 38), but seems to have about half a whorl less, which probably reflects intraspecific variability. Also the basal disc seems more strongly developed in the specimen illustrated by Peñas & Rolán (1997, fig. 37). However, the holotype is not fully adult (height 3.0 mm), and the basal disc is less evident in fully adult or gerontic specimen, as the Estepona specimens seems to be (height = 8.8.mm).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Ghana (Peñas & Rolán, 1997).

***Chemnitzia fiorenzae* (Chirli & Micali, 2011)**
Plate 91, fig. 1

*2011 *Turbonilla fiorenzae* Chirli & Micali, p. 77, pl. 27, figs 13-18.

Material and dimensions – Height 6.7 mm, width 1.7 mm. **CO**: NHMW 2019/0167/0483 (1). **EL**: NHMW 2019/0167/0430 (1), NHMW 2019/0167/0431 (33).

Discussion – *Chemnitzia fiorenzae* (Chirli & Micali, 2011) is characterised by its tall, solid, slender shell, with early whorls cyrtoconoid in profile, later conical-elongate. The protoconch is small, of type A2, with the nucleus partly submerged (Estepona specimen; dp = 215-225 μm, hp = 180-230 μm, tilted at about 115-117° to main shell axis). The teleoconch is composed of up to 13 low, convex whorls, separated by a moderately impressed, weakly undulating suture. Sculpture of broad, rounded, opisthocline axial ribs, 16-18 on penultimate whorl, slightly wider than their interspaces, on last two whorls terminating abruptly at a narrow suprasutural cord. The last whorl is convex, the ribs ending sharply at the periphery, forming well-defined basal disc, base smooth. The aperture is small, columella short, thickened, without a fold. The specimen figured here from Estepona is closely similar to the types from Italy illustrated by Chirli & Micali (2011, pl. 27, figs 13-18), of similar protoconch size (dp = 225 μm; Italian specimen), differing only in having slightly more convex whorls.

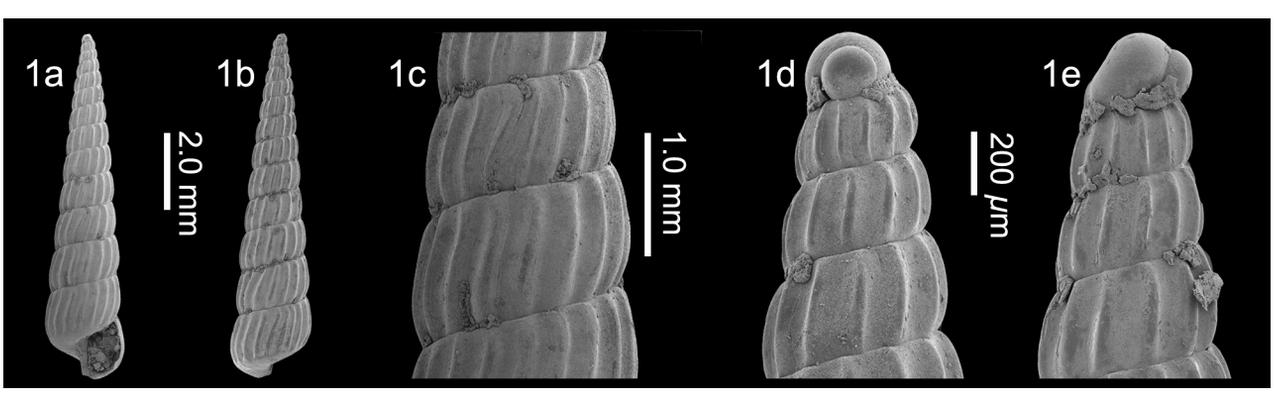

Plate 90. *Chemnitzia diezi* (Peñas & Rolán, 1997); 1. NHMW 2019/0167/0410, height 8.8 mm, width 2.0 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

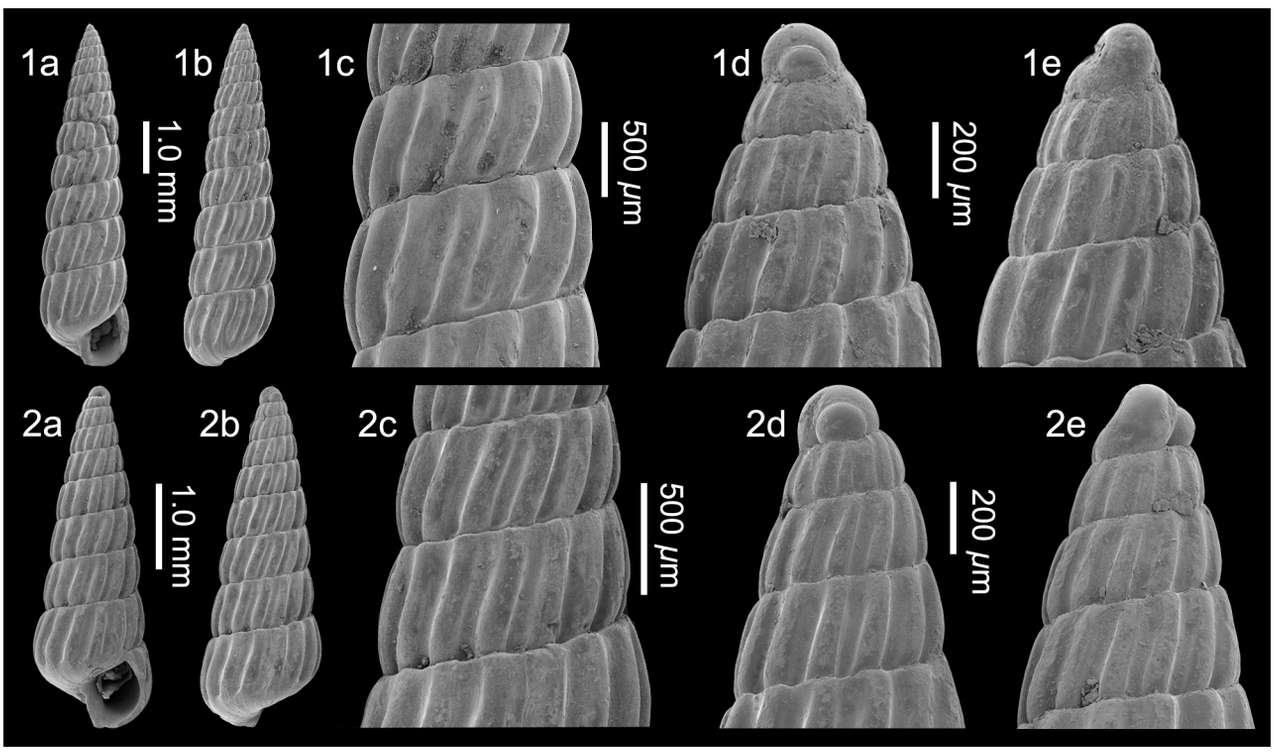

Plate 91. *Chemnitzia fiorenzae* (Chirli & Micali, 2011); 1. NHMW 2019/0167/0483, height 6.7 mm, width 1.7 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0430, height 4.0 mm, width 1.4 mm, 2c, detail of teleoconch sculpture last two spire whorls, 2d-e, detail of protoconch (all SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Chemnitzia fiorenzae differs from *C. lactea* (Linnaeus, 1758) in having a smaller protoconch of type A2 rather than B, in having a cyrotoconoid profile to early whorls and fewer ribs (*C. lactea*; 18-22, *fide* Fretter *et al*., 1986, p. 633). It is similar to *C. senegalensis* (von Maltzan, 1885) in that the ribs on the late teleoconch whorls end at a suprasutural cord, but it differs again in having a smaller protoconch (*C. senegalensis*; dp = 260 µm, *fide* Peñas & Rolán, 1997, p. 10) and the profile of the early whorls. *Chemnitzia isabelitae* (Peñas & Rolán, 2000) has a similar protoconch, but differs in having a slenderer profile, with a narrower apical angle, flexuous ribs from the initial whorls, and a more weakly undulating suture. *Chemnitzia florentina* (Costa, 1861) (see below) again differs in having a type B protoconch and in teleoconch profile, with a much narrower apical angle.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2014). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0288); western Mediterranean, Estepona Basin, Spain (this paper).

***Chemnitzia florentina* (Costa, 1861)**
Plate 92, fig. 1

*1861 *Chemniria* [*sic*] *florentina* Costa, O.G., p. 9, pl. 3, figs 1-2.

2011 *Turbonilla* cf. *florentina* (Costa, O.G., 1861) – Chirli & Micali, p. 77 , pl. 28, figs 1-6.

?*non*1888 *Turbonilla florentina* De Stefani, pl. 11, fig. 25 (= *T. exflorentina* Sacco, 1892; *species inquirenda*).

non 2011 *Turbonilla florentina* (Costa, O.G., 1861) – Chirli & Linse, p. 205, pl. 80, fig. 3 [= *Pyrgolidium internodulum* (Wood, 1848)].

Material and dimensions – Maximum height 4.7 mm, width 1.2 m. **CO**: NHMW 2019/0167/0167 (1), NHMW 2019/0167/0168 (2). **EL**: NHMW 2019/0167/0504 (1).

Discussion – Costa (1861) described this species from the lower Pliocene of San Miniato (Tuscany), Italy. The original description and illustration leave some doubt as to the identity of the species. However, we interpret this taxon as that figured by Chirli & Micali (2011, pl. 28, figs 1-6) and figured herein (Pl. 92, fig. 1). An attempt to trace the type material of the Oronzo Gabriele Costa (1787-1867) collection stored at the Museo di Storia Naturale in Naples did not receive any reply from that institution.
Chemnitzia florentina (Costa, 1861) is characterised by its type B protoconch (Estepona specimen; dp = 210-230 µm; hp = 167-195 µm, tilted at about 120° to main shell axis), teleoconch of 9-10 weakly convex whorls separated by impressed undulating suture, sculpture of 14-18 strongly opisthocline, slightly arched ribs, roughly equal in width to their interspaces that stop abruptly at the base.

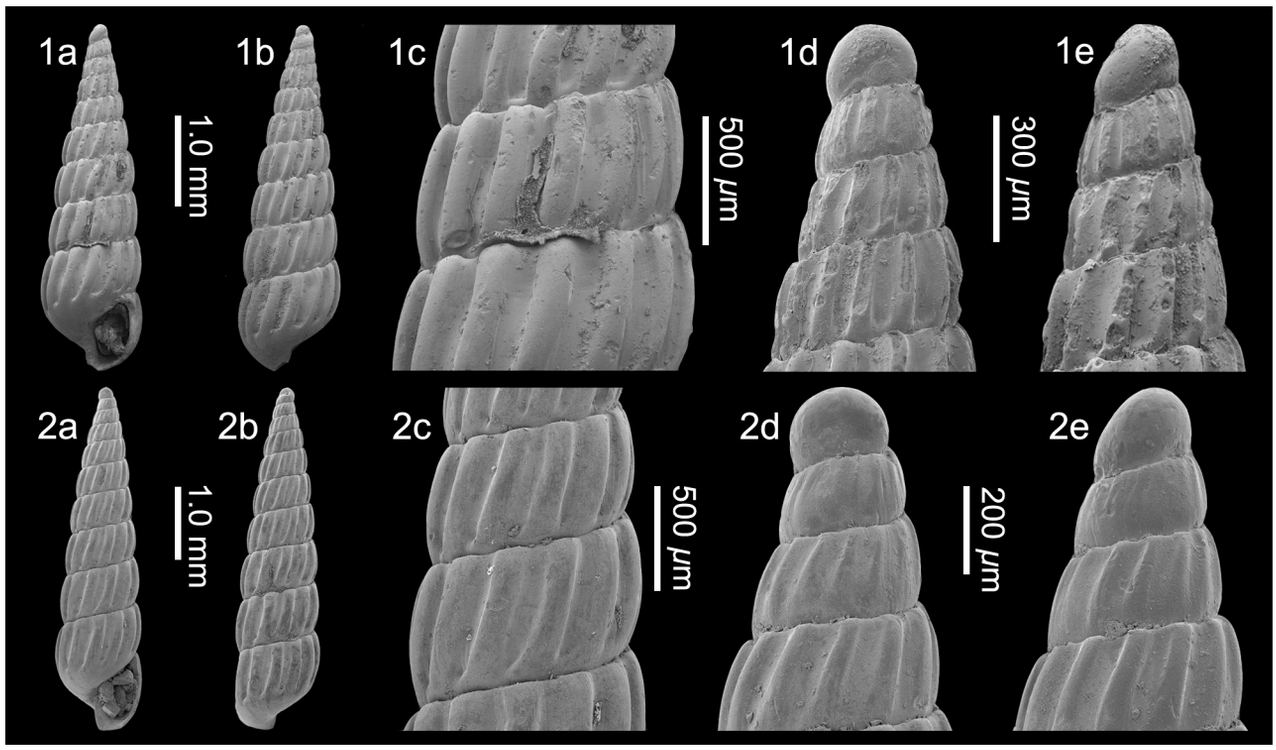

Plate 92. *Chemnitzia florentina* (Costa, 1861); 1. NHMW 2019/0167/0167, height 3.9 mm, width 1.2 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0504, height 4.7 mm, width 1.2 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

As noted by Chirli & Micali (2011, p. 78), Sacco (1892a, p. 75) did not consider the specimen figured by De Stefani (1888, pl. 11, fig. 25) as *Turbonilla florentina* to represent that species and renamed it *T. exflorentina* Sacco, 1892. De Stefani's figure is difficult to interpret and no specimen is present in the De Stefani collection (Stefano Dominici pers. comm. 24/11/2020), and is therefore considered a *species inquirenda*.

Chemnitzia pumila Seguenza, 1876 from the present-day European Atlantic and Mediterranean, and also known from the Pliocene Mediterranean (Chirli & Micali, 2011) differs in having a stouter profile, lower whorls, a protoconch of similar size, but more depressed (tilted at about 135° to main shell axis), and the ribs terminate less abruptly at the base. *Chemnitzia lactea* (Linnaeus, 1758), widespread in the middle Miocene to present-day European faunas, also has a type B protoconch, but larger (dp = 280-290 μm), has a lower initial teleoconch whorls creating a stouter apex, the ribs on the first teleoconch whorl coronate the suture [see Peñas *et al*., 1996, fig. 170 and Chirli & Micali, 2011, pl. 30, figs. 16, 17 (magnification indicated incorrect, *lapsus*)], and has a larger shell composed of 15-20 whorls and more numerous axial ribs (20-25).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2014). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Chemnitzia intuspersulcata* (Sacco, 1892)**
Plate 93, figs 1-3

*1892a	*Turbonilla lactea* var. *intuspersulcata*	Sacco, p. 73, pl. 2, fig. 47.
1969	*Turbonilla intuspersulcata*	Sacco – Fekih, p. 31, pl. 5, fig. 11.
1984	*Turbonilla lactea* var. *intuspersulcata*	Sacco, 1892 – Ferrero Mortara *et al*., p. 80.
2011	*Turbonilla intuspersulcata*	Sacco, 1892 – Chirli & Micali, p. 82, pl. 29, figs 13-18.
2016	*Turbonilla intuspersulcata*	Sacco, 1892 – Bellagamba & Micali, p. 143, figs 4A-C.

Material and dimensions – Maximum height 9.8 mm, width 2.6 mm. **CO**: NHMW 2019/0167/0129 (10), NHMW 2019/0167/0306 (12). **VC**: NHMW 2019/0167/0144 (1), NHMW 2019/0167/0145 (14), NHMW 2019/0167/0286-0287 (2), NHMW 2019/0167/0513 (14). **VS**: NHMW 2019/0167/0859 (6). **EL**: NHMW 2019/0167/0218 (13).

Discussion – *Chemnitzia intuspersulcata* (Sacco, 1892) is characterised by its elongated regularly conical shell with relatively broad apical angle, type A2 protoconch (Estepona specimen; dp = 273-290 μm, hp = 270 μm, dn = 65 μm, tilted at about 110° to main shell axis), teleoconch of up to 12 low whorls, early whorls convex, abapically straight-sided, separated by a superficial, linear suture, sculpture of 18-20 narrow, straight to slightly curved,

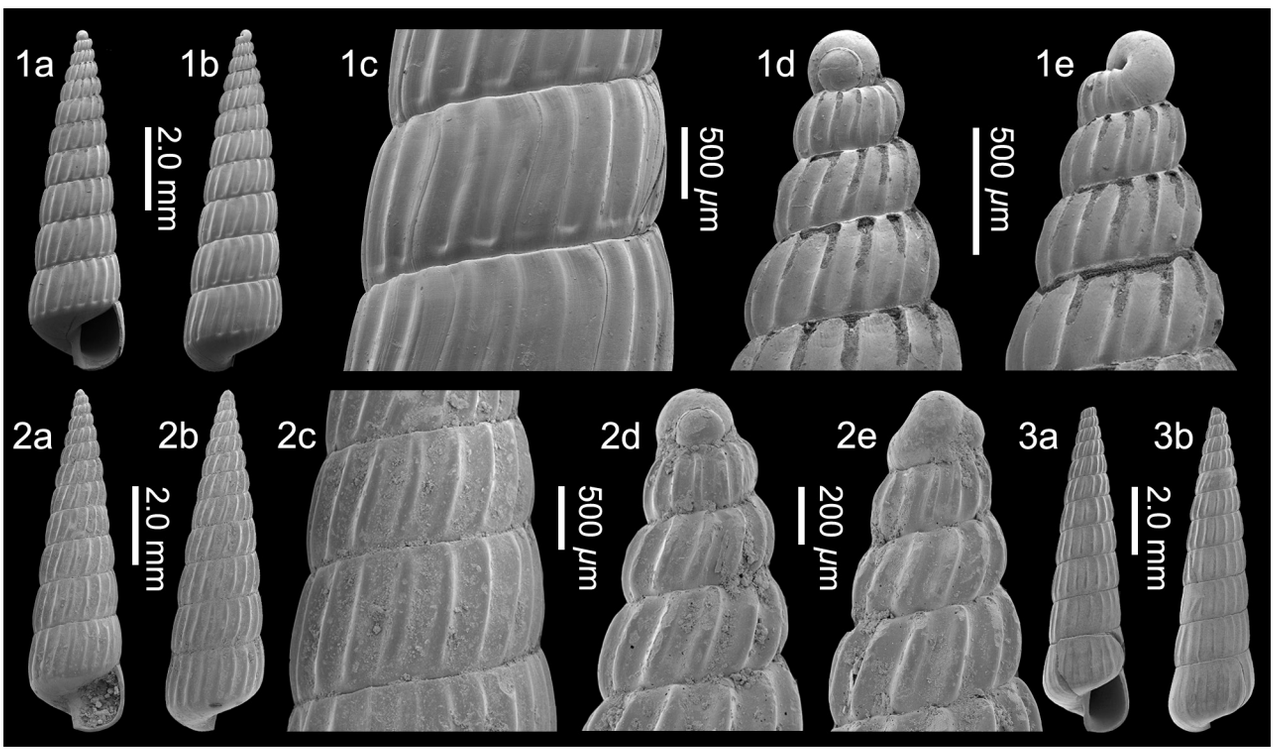

Plate 93. *Chemnitzia intuspersulcata* (Sacco, 1892); 1. NHMW 2019/0167/0144, height 8.2 mm, width 2.3 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0286, height 8.9 mm, width 2.5 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of protoconch; 3. NHMW 2019/0167/0287, height 9.8 mm, width 2.6 mm (all SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

opisthocline ribs, narrower than their interspaces, last whorl straight-sided, strongly convex at the periphery, base depressed, the ribs stopping abruptly at the periphery, but without forming a well-defined basal disc, base smooth, aperture subquadrate, columella short, vertical, with a modest fold placed within.

Originally described as a variety of *C. lactea* (Linnaeus, 1758), it differs in having a type A2 protoconch instead of type B in *C. lactea*, in having a wider apical angle, narrower ribs, and a more depressed base.

Turbonilla elongata De Stefani & Pantanelli, 1879 was introduced for a Pliocene Italian species from around Siena. Pantanelli (1884, p. 25) considered the name a secondary homonym of *Pyrgiscus elongatus* Philippi, 1844, and introduced the new name *Turbonilla columnaris* Pantanelli, 1884. However, this is also secondary homonym of *Melania columnaris* Sismonda, 1842, and was replaced by Sacco (1892b, p. 7) with *excolumnaris*. The original description "*Testa turrita, cilindrata, elongata, nitida, laevigata; anfractus planiusculi, suturis distinctis divisi; altitudine bis tertiam partem longitudinis aequante; longitudinaliter costati; costellae rectae, circiter 22, interdum irregulariter dichtotomae in anfractu ultimo prope basim carentes; apertura subquadrata. Alt. 14''' Larg. 2''',8. Il maggior numero delle coste longitudinali e la forma meno angolosa distinguono questa specie dalla* T. costellata *Grat., dell'Hörnes colla quale essa ha strettissima affinità* [Shell turreted, cylindrical, elongate, clear, smooth; whorls quite flat, separated by a well-marked suture; whorl height about 2/3 of width; axial ribs; ribs straight, approx. 22, sometimes irregularly doubled, not present over the base; aperture square. Height 14 mm width 2.8 mm. The greater number of axial ribs and the less agnulate outline separate this species from the *T. costellata* Grat., as interpreted by Hörnes, with which it has a very close affinity]" by De Stefani & Pantanelli (1879, p. 154; under *T. elongata*), could fit with this Estepona specimen when stressing in their comparison with *T. costellata* Grateloup, 1828 the greater number of axial ribs and the less angular profile. Neither De Stefani & Pantanelli (1879), nor Pantanelli (1884) figured their species, nor did Sacco (1892a, b). It is possible that Pantanelli's species fits within the variability of *C. intuspersulcata*, but in the absence of a figure, and the original material (no reply from the palaeontological museum in Modena), it is considered *species inquirenda*.

Distribution – Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0289); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Bellagamba & Micali, 2016).

***Chemnitzia lactea* (Linnaeus, 1758)**
Plate 94, figs 1-2

*1758 *Turbo lacteus* Linnaeus, p. 765.
1803 *Turbo elegantissimus* Montagu, p. 298, pl. 10, fig. 2.
1836 *Melania campanellae* Philippi, p. 156, pl. 9, fig. 5.
1836 *Rissoa turritella* Scacchi, p. 15, note 29, fig. 24.
1882 *Turbonilla lactea* Linné – Bucquoy *et al*., p. 178, pl. 21, figs 6, 7.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *Gastaldi* (Semp.) – Sacco, p. 72, pl. 2, fig. 44.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *turritolonga* Sacco, p. 73, pl. 2, fig. 45.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *pliosigmoidea* Sacco, p. 73, pl. 2, fig. 46.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *pliosimilis* Sacco, p. 73, pl. 2, fig. 48.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *perplicatosulcata* Sacco, p. 74, pl. 2, fig. 49.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *convexulosulcata* Sacco, p. 74, pl. 2, fig. 50.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *pliogigantea* Sacco, p. 74, pl. 2, fig. 51.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *elegans* (Segu.) – Sacco, p. 74, pl. 2, fig. 52.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *paucicostata* (Segu.) – Sacco, p. 75, pl. 2, fig. 53.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *bevicostulata* Sacco, p. 75, pl. 2, fig. 54.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *pseudoflorentina* Sacco, p. 75, pl. 2, fig. 55.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *turritoparva* Sacco, p. 75, pl. 2, fig. 56.
1892a *Turbonilla* (*Turbonilla*) *lactea* var. *conicoparvula* Sacco, p. 75, pl. 2, fig. 57.
1904 *Chemnitzia Campanellae* (Phil.) – Sacco, p. 109, pl. 24, fig. 12.
1914 *Turbonilla lactea* L. – Cerulli-Irelli, p. 267 [441], pl. 23 [55], figs 20-29.
1914 *Turbonilla lactea* var. *hoernesiana* Sacco – Cerulli-Irelli, p. 268 [442], pl. 23 [55], figs 30, 31.
1920 *Turbonilla lactea* (Linné) – Harmer, p. 559, pl. 49, figs 17, 18.
1964 *Turbonilla elegantissima* var. *gastaldi* Semper, 1861 – Brébion, p. 293 [*non Chemnitzia gastaldi* (Semper, 1861)].
1969 *Turbonilla lactea* (Linné) – Fekih, p. 28, pl. 4, fig. 11.
1969 *Turbonilla lactea* var. *turritolonga* Sacco – Fekih, p. 28, pl. 4, fig. 12.
1969 *Turbonilla lactea* var. *hoernesiana* Sacco – Fekih, p. 28, pl. 4, fig. 13.
1972b *Turbonilla lactea* (Linné, 1767 [*sic*]) – Nordsieck, p. 122, pl. PV, fig. 11.
1974 *Turbonilla* (*Turbonilla*) *lactea* (Linné, 1758) – Malatesta, p. 439, pl. 32, fig. 15.
1986 *Turbonilla lactea* (Linnaeus, 1758) – Fretter *et al*., p. 633, figs 441, 442.
1988 *Turbonilla lactea* (Linné, 1758) – Graham, p. 622, fig. 271.
1992 *Turbonilla lactea* (L., 1758) – Cavallo & Repetto, p. 162, fig. 461.
1996 *Turbonilla lactea* (Linneo, 1758) – Peñas *et al*., p. 66, figs 163, 164, 170.
1997 *Turbonilla lactea* (Linné, 1758) – Peñas & Rolán, p. 24, figs 39-43.
1997 *Turbonilla lactea* (Linné) – Ruiz Muñoz *et al*., p. 186, pl. 40, figs 18-19.
2001 *Turbonilla lactea* (Linnaeus, 1758) – Cachia *et al*., p. 112, pl. 18, fig. 7.
2005 *Turbonilla lactea* (Linnaeus, 1758) – Rolán, p. 197, fig. 904.
2009 *Turbonilla lactea* (Linnaeus, 1758) – de Frias Martins *et al*., p. 66, fig. 270.
2011 *Turbonilla lactea* (Linnaeus, 1758) – Landau *et al*., p. 41, pl. 22, fig. 15.
2011 *Turbonilla lactea* (Linné, 1758) – Chirli & Micali, p. 84, pl. 30, figs 7-18 (*cum syn*.).
?2011 *Turbonilla pliomagna* Sacco, 1892 – Chirli & Micali, p. 92, pl. 33, figs 7-12 [*non Chemnitzia pliomagna* (Sacco, 1892)].
2011 *Turbonilla lactea* (Linné, 1758) – Chirli & Linse, p. 207, pl. 82, fig. 1.
2011 *Turbonilla lactea* (Linnaeus, 1758) – Hernández *et al*., p. 266, figs 90N-O.
2013 *Turbonilla lactea* (Linnaeus, 1758) – Öztürk & Bitlis Bakir, p. 431, fig 18.
2014 *Turbonilla lactea* (Linné, 1757 [*sic*]) – Giannuzzi-Savelli *et al*., p. 80, figs 249-252.
2018 *Chemnitzia lactea* (Linnaeus, 1758) – Ceulemans *et al*., p. 134, pl. 8, figs 9-11 (*cum syn*.).
2018 *Turbonilla lactea* (Linneo, 1758) – Trigo *et al*., p. 363, fig . 41.
2020 *Chemnitzia lactea* (Linnaeus, 1758) – Landau *et al*., p. 328, pl. 57, fig. 1.

?*non* 1848 *Chemnitzia elegantissima* Mont. – Wood, p. 81, pl. 10, fig. 5 (= *Chemnitzia elegantior* Wood, 1872).
non 1892a *Turbonilla* (*Turbonilla*) *lactea* var. *intuspersulcata* Sacco, p. 73, pl. 2, fig. 47 [= *Chemnitzia intuspersulcata* (Sacco, 1892)].

Material and dimensions – Maximum height 7.2 mm, width 1.6 mm. **CO**: NHMW 2019/0167/0405 (1), NHMW 2019/0167/0406 (14). **VS**: NHMW 2019/0167/0605 (1), NHMW 2019/0167/0855 (6). **EL**: NHMW 2019/0167/0434 (13).

Discussion – *Chemnitzia lactea* (Linnaeus, 1758) is characterised by its tall, slender shell, type B protoconch (Estepona specimen; dp = 227 μm, hp = 160, tilted at about 125° to main shell axis), teleoconch of up to 20 weakly convex whorls, sculpture of 20-25 curved, opisthocline axial ribs, each equal in width to broader than their interspaces, not extending onto the base on the last whorl, but ending abruptly at the periphery, and absence of umbilicus or columellar fold. Peñas & Rolán (1997, p. 25) noted that the protoconch size differs amongst extant populations, measuring dp = 280 μm in some specimens from the Mediterranean and Cape Verde Islands. For speci-

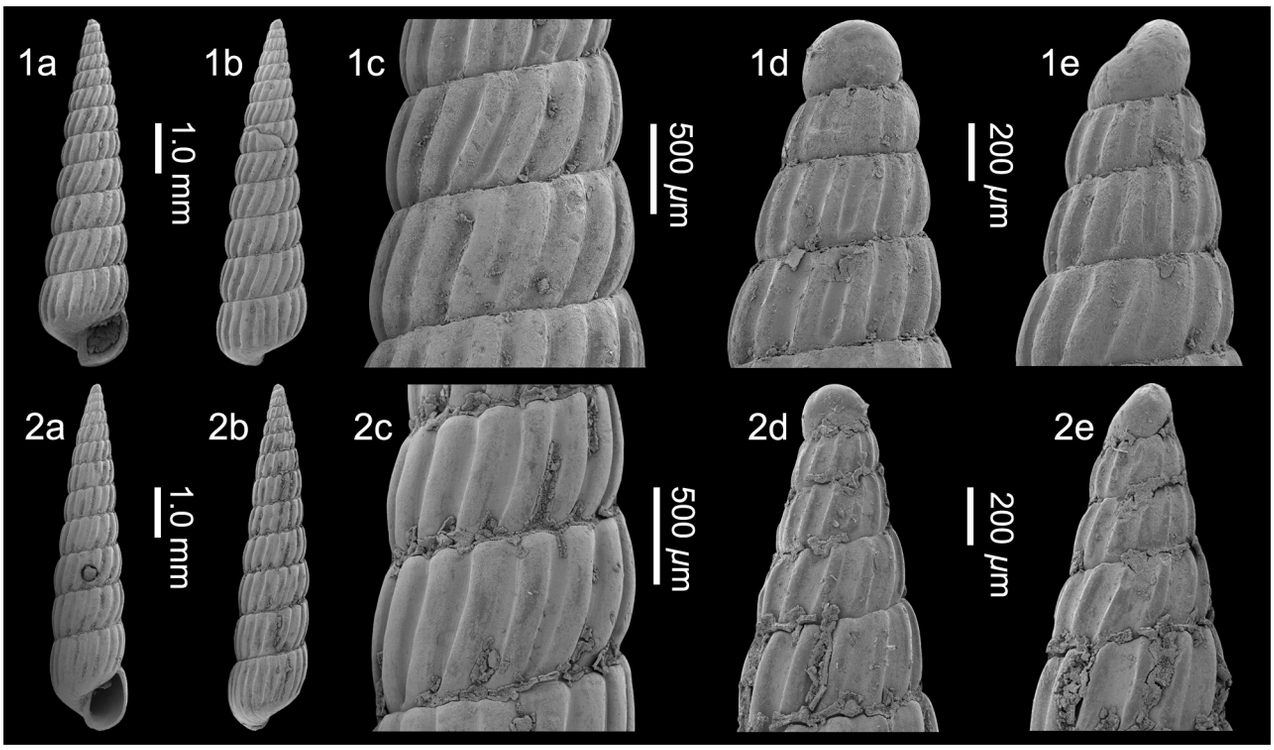

Plate 94. *Chemnitzia lactea* (Linnaeus, 1758); 1. NHMW 2019/0167/0605, height 7.1 mm, width 1.7 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch. Velerín sands. 2. NHMW 2019/0167/0405, height 7.2 mm, width 1.6 mm, 2c, detail of teleoconch sculpture last two spire whorls, 2d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

mens from the British Isles Fretter *et al*. (1986, p. 633) noted a dp = 300 μm, and hp = 400-500 μm. Peñas & Rolán also noted a "*una forma minúscula*..." (1997, p. 25) from São Tomé and the Gulf of Guinea, dp = 230 μm, which compares in size to that of the Estepona specimens.

Turbonilla campanellae (Philippi, 1836) is a tall slender form of *C. lactea* and considered a synonym. *Chemnitzia gastaldi* auct. (*e.g*., Anderson, 1964) from the early-middle Miocene North Sea Basin has a shell similar to that of *C. lactea* (Linnaeus, 1758), but differs in having a slightly wider apical angle, squatter spire whorls, a more superficial suture, fewer but stronger axial ribs, and a protoconch of type A2, strongly helicoidal. Specimens from the North Sea Basin Miocene illustrated by Wienrich (2007, pl. 164, figs 5-6) show quite some variability in rib density, which is also true of *C. lactea* from the Italian Pliocene (Chirli & Micali, 2011, pl. 30, figs 7-18).

Distribution – Upper Miocene: Atlantic, NW France (Landau *et al*., 2020). Lower Pliocene: Atlantic, northwestern France (Brébion, 1964; Ceulemans *et al*., 2018), Guadalquivir Basin, Spain (Ruiz Muñoz *et al*., 1997; Landau *et al*., 2011); western Mediterranean, Tunisia (Fekih, 1969); central Mediterranean, Italy (Sacco, 1892a; Guioli *et al*., 2009; Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Peñas & Rolán, 1997); central Mediterranean, Italy (Sacco, 1892a; Greco, 1971; Malatesta, 1974; Cavallo & Repetto, 1992; Ferrero *et al*., 2005). Upper Pliocene-Pleistocene: Atlantic, NW France (Brébion, 1964). Lower Pleistocene: Atlantic, St. Erth, England (Harmer, 1920); central Mediterranean, Italy (Cerulli-Irelli, 1914). Upper Pleistocene: English Channel, England (Harmer, 1920); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Present-day: Atlantic frontage from North Norway to British Isles, North Sea (Raven, 2020), northwestern Spain (Trigo *et al*., 2018), Cabo Verde and São Tomé (Rolán, 2005; Peñas *et al*., 2009), Azores (de Frias Martins *et al*., 2009), Madeira and Selvagens Islands (Segers *et al*., 2009), into western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *&* Bitlis Bakir, 2013), Canaries (Hernández *et al*., 2011),.

Chemnitzia ligustica (Sacco, 1892)

Plate 95, fig. 1

*1892a	*Turbonilla postacuticostata* var. *ligustica* Sacco, p. 76, pl. 2, fig. 59.
2011	*Turbonilla ligustica* Sacco, 1892 – Chirli & Micali, p. 88, pl. 31, figs 7-11.

Material and dimensions – Maximum height 5.3 mm, width 1.6 mm. **CO**: NHMW 2019/0167/0826 (4). **VC**: NHMW 2019/0167/0149 (1), NHMW 2019/0167/0150 (30). **EL**: NHMW 2019/0167/0834 (4).

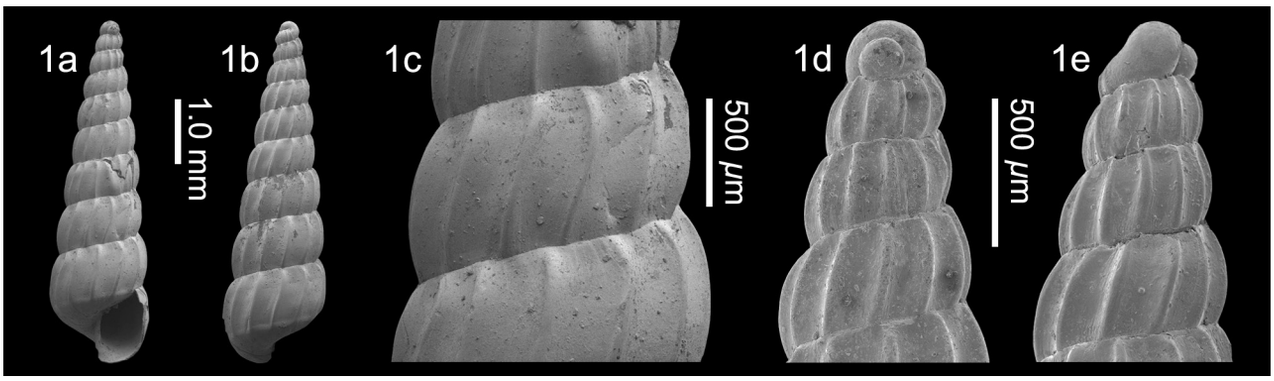

Plate 95. *Chemnitzia ligustica* (Sacco, 1892); 1. NHMW 2019/0167/0149, height 5.3 mm, width 1.6 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Chemnitzia ligustica* (Sacco, 1892) is characterised by its elongate conical profile, thin shell, and type A2 helicoid protoconch (Estepona specimen; dp = 270 μm, hp = 260 μm, tilted at about 115° to main shell axis). The teleoconch consists of 8-10 convex whorls, separated by a relatively deep, linear suture. Sculpture consists of 13-16 narrow, opisthocline, straight to slightly flexuose axial ribs, separated by wide interspaces. The ribs stop abruptly at a peribasal cord. The aperture is subquadrate and the columella straight and hardly thickened. This species was originally described as a variety of *C. postacuticostata* (Sacco, 1892), a name erected by Sacco to replace *Turbonilla acuticostata* Jeffreys, 1884, *non* Speyer, 1870 from present-day Mediterranean & West Africa (see Micali, 1988; Peñas & Rolán, 2000). Chirli & Micali (2011, p. 88) elevated the fossil subspecies to full species rank, differing in being twice the size of *C. postacuticostata* and having more convex whorls, and fewer, thinner ribs, separated by wider interspaces. *Chemnitzia pliomagna* (Sacco, 1892), also originally described as a variety of *C. postacuticostata*, also differs in the same characters. *Chemnitzia ligustica* differs from all its Estepona congeners in having much narrower ribs.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a).

***Chemnitzia luandensis* (Peñas & Rolán, 1997)**
Plate 96, figs 1-2

*1997 *Turbonilla luandensis* Peñas & Rolán, p. 34, figs 60-62.

Material and dimensions – Maximum height 11.7 mm, width 2.7 mm. **VC**: NHMW 2019/0167/0739-0740 (2), NHMW 2019/0167/0741 (3). **EL**: NHMW 2019/0167/0832 (8).

Discussion – *Chemnitzia luandensis* (Peñas & Rolán, 1997) is characterised by its tall conical profile, small type A2 protoconch of about two whorls with a large nucleus (Estepona specimen; dp = 245-260 μm, hp = 300-310 μm, dn = 125-145 μm, tilted at about 105-110° to main shell axis) and teleoconch of up to 13 low, initially strongly convex, weakly convex abapically, separated by a moderately impressed suture. The teleoconch whorls bear broad, rounded, slightly curved, opisthocline ribs, roughly equal to slightly wider than their interspaces, about 15-16 on the penultimate whorl. The surface appears smooth and glossy, but under magnification is covered in very fine microscopic spiral grooves that cross the intervals and ribs. The last whorl is weakly convex to the periphery, rounded at the base; the ribs stop abruptly at the periphery, forming a poorly to moderately defined basal disc. The aperture is subquadrangular, and the columella straight, without a fold. We also note the presence of well-developed lirae starting deep within the aperture, not mentioned in the original description

Despite the microscopic spiral sculpture, we have placed this species in the genus *Chemnitzia* d'Orbigny, 1840 based on the moderately well-developed basal disc. Other possible placements are in the genus *Strioturbonilla* Sacco, 1892, which has more clearly developed spiral sculpture, and *Turbonilla* Risso, 1826 in which there is no spiral sculpture and no basal disc and the ribs persist, albeit weakened, some distance onto the base.

No other turbonillid in the Estepona assemblage has similar crowded spiral microsculpture. Due to this microsculpture Peñas & Rolán, 1997) compared it to the extant West African *T. pseudomarteli* Peñas & Rolán, 1997 and *T. fulgidula* (Jeffreys, 1884), but these two latter species are small, with a type A1 protoconch, cylindrical profile and are quite unlike *Chemnitzia* species. Already in the original description Peñas & Rolán noted the presence of *C. luandensis* in the Pliocene of Estepona.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Peñas & Rolán, 1997). Present-day: Atlantic, West Africa, Angola (Peñas & Rolán, 1997, 2000).

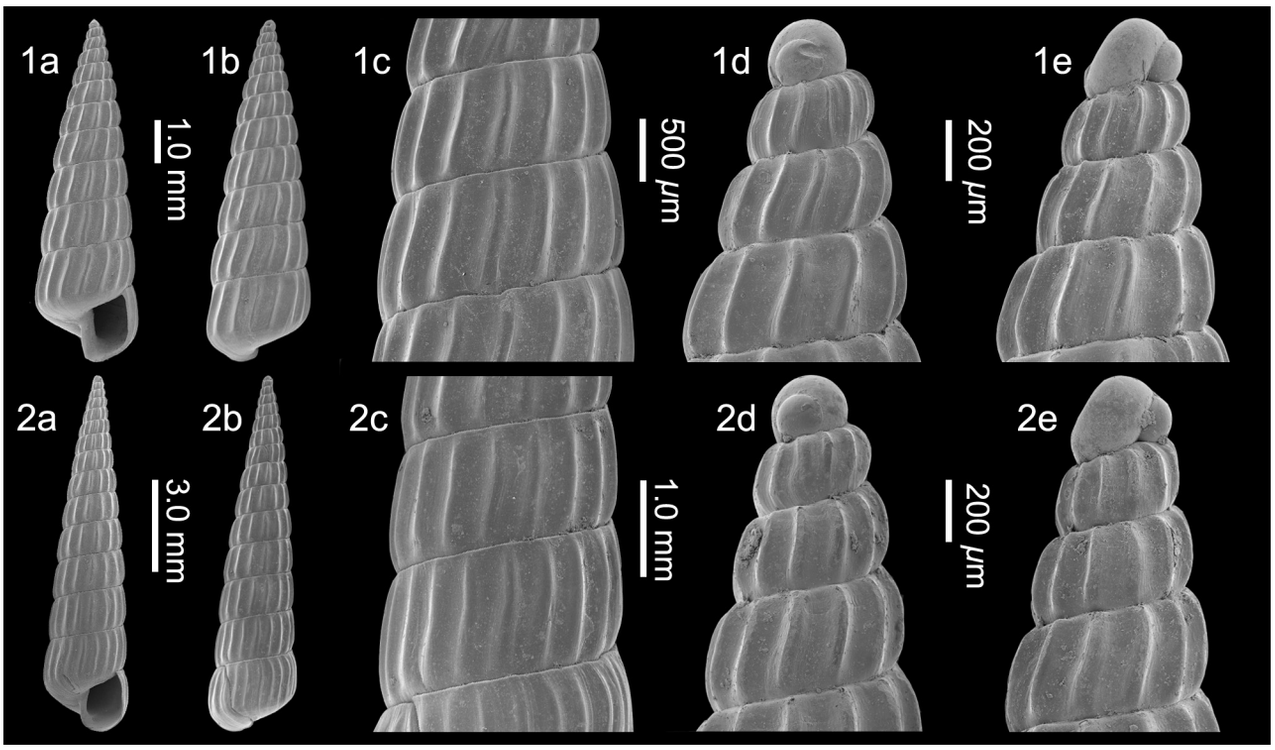

Plate 96. *Chemnitzia luandensis* (Peñas & Rolán, 1997); 1. NHMW 2019/0167/0739, height 7.8 mm, width 2.4 mm, 1c, detail of teleoconch sculpture last two whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0740, height 11.7 mm, width 2.7 mm, 2c, detail of teleoconch sculpture last two whorls, 2d-e, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

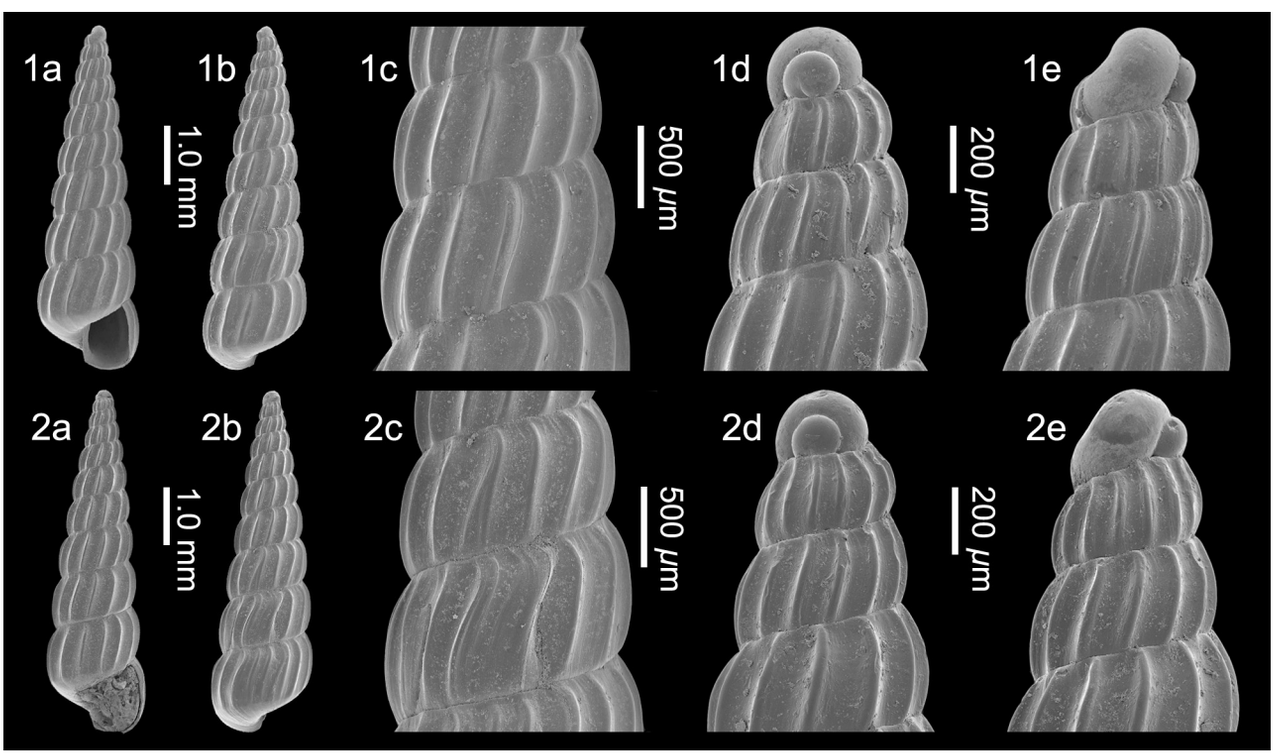

Plate 97. *Chemnitzia pliomagna* (Sacco, 1892); 1. NHMW 2019/0167/0702, height 5.9 mm, width 1.7 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0703, height 6.1 mm, width 1.7 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Chemnitzia pliomagna* (Sacco, 1892)**
Plate 97, figs 1-2

*1892a	*Turbonilla postacuticostata* var. *pliomagna* Sacco, p. 76, pl. 3, fig. 1.
1966	*Turbonilla* (*Turbonilla*) *pliomagna* Sacco – Moroni & Torre, p. 3, fig. 1.
1984	*Turbonilla postacuticostata* var. *pliomagna* Sacco, 1892 – Ferrero Mortara *et al*., p. 81, pl. 12, fig. 7.
2004	*Turbonilla pliomagna* Sacco, 1892 – Bogi & Chirli, p. 92, fig. Q.
non 2011	*Turbonilla pliomagna* Sacco, 1892 – Chirli & Micali, p. 92, pl. 33, figs 7-12 [= ?*Chemnitzia lactea* (Linnaeus, 1758)].

Material and dimensions – Maximum height 6.1 mm, width 1.7 mm. **VC**: NHMW 2019/0167/0280 (1), NHMW 2019/0167/0281 (20), NHMW 2019/0167/0702-0703 (2). **EL**: NHMW 2019/0167/0728 (1).

Discussion – *Chemnitzia pliomagna* (Sacco, 1892) is characterised by its rather fragile, slender shell composed up to nine convex whorls, separated by a moderately deep suture, and type A2 protoconch composed of two whorls with a large nucleus (Estepona specimen; dp = 280-285 μm, hp = 285-290 μm, dn = 110-121 μm, tilted at about 115-117° to main shell axis). Sculpture consists of 16-18 straight, orthocline axial ribs, slightly narrower than their interspaces that on the last whorl stop abruptly at the base, but without forming a well-developed basal disc. The aperture is small and the columella straight, without a fold. This species was originally described as variety of *Turbonilla postacuticostata* Sacco, 1892 (figured in Peñas & Rolán, 2000 p. 64, figs 16-22; Giannuzzi-Savelli *et al*., p. 80, fig. 261), from which it differs in its larger size (about 6 mm against 3.5 mm), the faster growth rate, the greater spire angle, the less protruding protoconch, and the narrower and more opisthocline ribs. The specimens figured in Chirli & Micali (2011 p. 92, pl. 33, figs 7-12) are possibly *Chemnitzia lactea* (Linnaeus, 1758).

Distribution – Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a; Bogi & Chirli, 2004). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Chemnitzia plioperstricta* (Chirli & Micali, 2011)**
Plate 98, figs 1-3

*2011	*Turbonilla plioperstricta* Chirli & Micali, p. 93, pl. 33, figs 13-18.

Material and dimensions – Maximum height 4.1 mm, width 795 μm. **CO**: NHMW 2019/0167/0400 (1). **VC**: NHMW 2019/0167/0142-0143 (5), NHMW 2019/0167/0482 (2). **EL**: NHMW 2019/0167/0432 (50+).

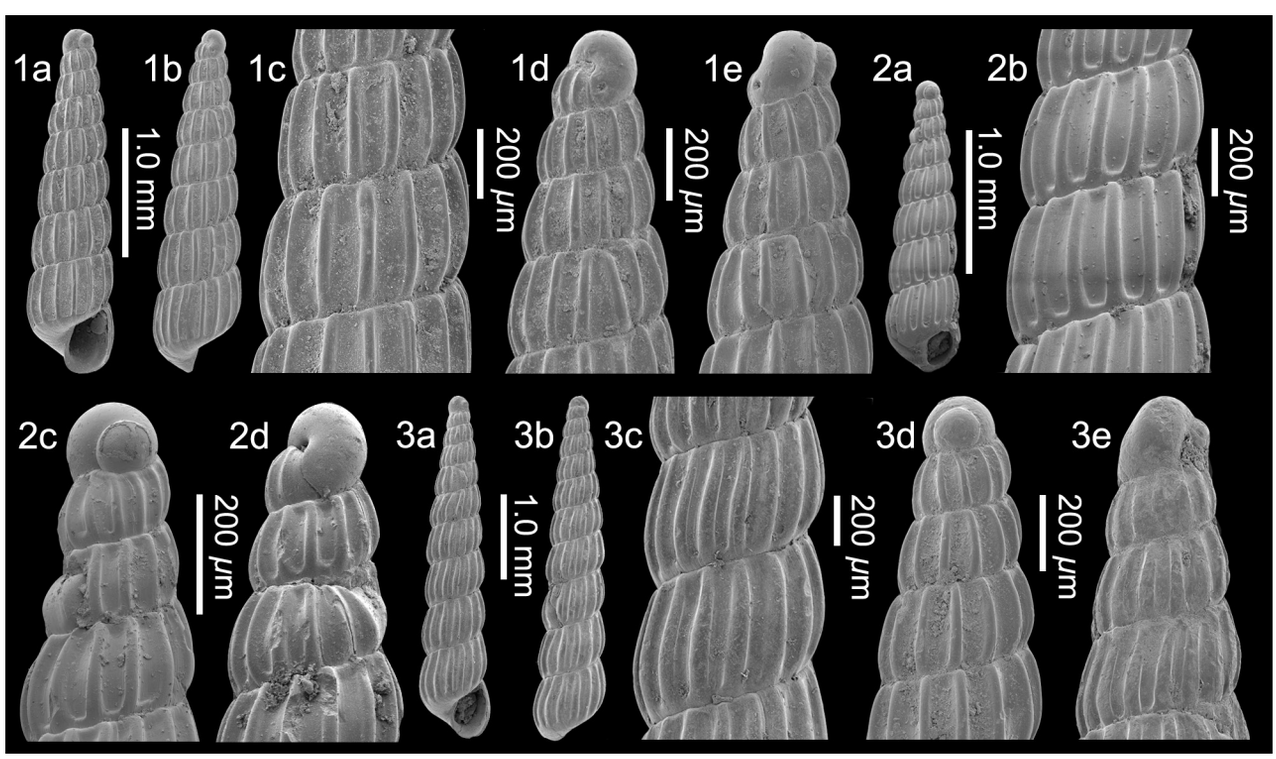

Plate 98. *Chemnitzia plioperstricta* (Chirli & Micali, 2011); 1. NHMW 2019/0167/0142, height 2.7 mm, width 685 μm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0143, height 2.4 mm, width 630 μm, 2b, detail of sculpture last two spire whorls, 2c-d, detail of protoconch. Velerín carretera. 3. NHMW 2019/0167/0400, height 4.1 mm, width 795 μm, 3c, detail of sculpture last two spire whorls, 3d-e, detail of protoconch (all SEM images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Chemnitzia plioperstricta* (Chirli & Micali, 2011) is characterised by its slender shell composed up to 12 strongly convex whorls, separated by a moderately deep, strongly oblique suture, and type A2 protoconch (Estepona specimen; dp = 200 μm, hp = 205-210 μm, tilted at about 100° to main shell axis). Sculpture consists of 14-16 straight, orthocline axial ribs (20-22 weakly arched and opisthocline on last whorl), slightly narrower than their interspaces, that on spire whorls crenulate the adapical suture and end abruptly at a prominent suprasutural cord (somewhat variably developed), and on the last whorl stop abruptly at the base. The aperture is small and the columella straight, without a fold. Another *Chemnitzia* species with an A2 type protoconch is *Chemnitzia postacuticostata* (Sacco, 1892) from the Mediterranean Pliocene to present-day, differs in being less slender, having a larger protoconch, and a less oblique suture.
Chemnitzia diezi (Peñas & Rolán, 1997), originally described from the present-day coasts of Miamia and Ghana, but also occurs in the Estepona assemblages (see above), differs in being stouter, with the protoconch more than double the size, the nucleus protruding from the outline of first teleoconch whorl, the teleoconch whorls are more convex, with stronger ribs, and it lacks the suprasutural cord.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0297); western Mediterranean, Estepona Basin, Spain (this paper).

***Chemnitzia* cf. *pliosimilis* (Sacco, 1892)**
Plate 99, fig. 1

*1892a *Turbonilla lactea* var. *pliosimilis* Sacco, p. 74, pl. 2, fig. 48.

Material and dimensions – Maximum height 13.2 mm, width 3.3 mm. **CO**: NHMW 2019/0167/0109 (1), NHMW 2019/0167/0110 (1).

Description – Shell relatively large, solid, with, tall narrow, conical spire. Protoconch not preserved. Teleoconch of 13 low, very weakly convex whorls, periphery placed just above suture, separated by shallow, linear, slightly oblique suture. Axial ribs rounded, opisthocline, comma-shaped, equal or slightly wider than their interspaces, 27 on last whorl; ribs do not reach abapical suture on last six whorls, but end at narrow suprasutural cord. Last whorl 30% total height, slightly concave below suture, rounded at periphery and base; basal disc moderately developed, ribs ending abruptly at disc edge; the base is imperforate. Aperture pyriform, 17% total height, outer lip rounded, not flared abapically. Columella straight, fold not visible (possibly internal, obscured by matrix); columellar callus thickened, sharply delimited, slightly erect.

Discussion – This relatively large turbonillid fits well within the genus *Chemnitzia* d'Orbigny, 1840, having

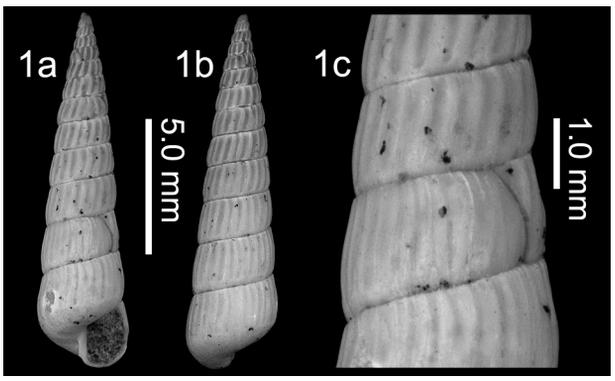

Plate 99. *Chemnitzia* cf. *pliosimilis* (Sacco, 1892); 1. NHMW 2019/0167/0109, height 13.2 mm, width 3.3 mm, 1c, detail of teleoconch sculpture (digital images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

prominent axial ribs, which terminate at a suprasutural cord, separated by deeply-sunken interspaces, no spiral sculpture, a smooth base, and a straight columella.
It might represent *Chemnitzia pliosimilis* (Sacco, 1892) described from the upper Pliocene of Italy. That species, originally described as a variety of *C. lactea* (Linnaeus, 1758), was compared by Sacco with *C. intuspersulcata* (Sacco, 1892), and said to differ in having "*In anfractibus ultimis costae aliquantulum propinquiores et obliquiores, interdum laeviter depressiores* [ribs more crowded and oblique on last whorls, sometimes a little more depressed]" (Sacco, 1892a, p. 74). Indeed, *C. intuspersulcata* is closely similar in profile and also has the ribs ending at a suprasutural cord, but as noted by Sacco has fewer ribs (18-20) separated by wider interspaces. With the scant Estepona material available and lack of protoconch characters, this species is left in open nomenclature.
It also resembles *Chemnitzia saccoi* (Cossmann & Peyrot, 1917) from the lower Miocene Aquitanian of the Aquitaine Basin, France in size, whorl profile and sculpture, but differs most noticeably in having more numerous ribs (27 vs 20-24 for *C. saccoi*; *fide* Cossmann & Peyrot, 1917). Unfortunately, the original description does not discuss the protoconch, and the apex of the syntype (MNHN.F.J05650), illustrated on the Paris Natural History Museum website, is also missing. Present day species *Turbonilla scrobiculata* Schander, 1994 from West Africa has similar profile, but a sharply delimited base. *Turbonilla speciosa* H. Adams, 1869 from the Atlantic Spanish coast differs in having more tapered and narrower apical whorls, the whorls are lower, and about double the number of axial ribs.

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

***Chemnitzia silvai* nov. sp.**
Plate 100, fig. 1

2018 *Turbonilla* sp. C – Brunetti & Cresti, p. 112, fig. 497

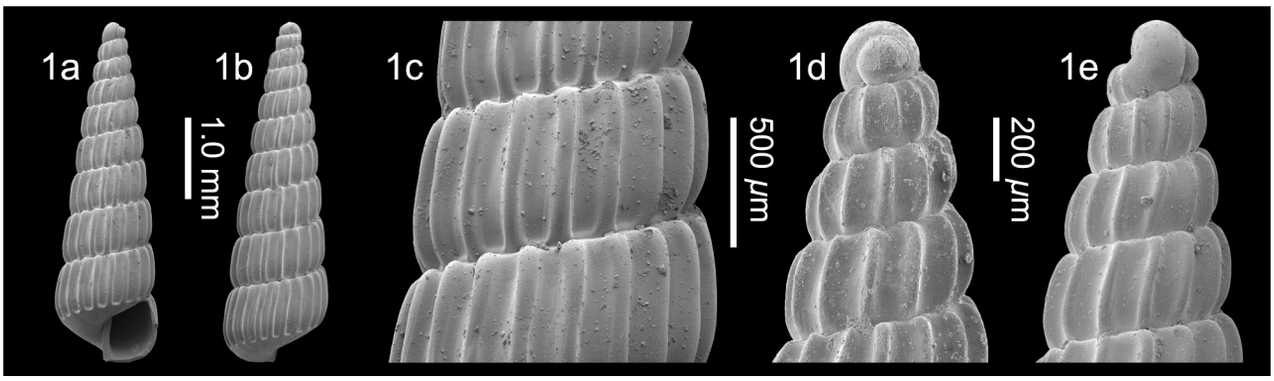

Plate 100. *Chemnitzia silvai* nov. sp.; 1. **Holotype** NHMW 2019/0167/0175, height 4.2 mm, width 1.3 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Type material – Holotype NHMW 2019/0167/0175, height 4.2 mm, width 1.3 mm; paratype 1 NHMW 2019/0167/0176, height 4.1 mm, width 1.3 mm; paratype 2 NHMW 2019/0167/0156; paratype 3 NHMW 2019/0167/0177, height 4.2 mm, width 1.2 mm¸ paratype 4 NHMW 2019/0167/0178, height 4.3 mm, width 1.2 mm.

Other material – **CO**: NHMW 2019/0167/0303 (4). **VC**: NHMW 2019/0167/0179 (13). **EL**: NHMW 2019/0167/0830 (1).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – In honour of our good friend and colleague palaeontologist Professor Carlos Marques da Silva from the University of Lisbon. Hardly a paper of BL is published without his help. *Chemnitzia* gender feminine.

Diagnosis – *Chemnitzia* species of very small size, regularly conical profile, type A2 protoconch, 8-9 low whorls, sculptured by 18-20 sharp opisthocline ribs ending abruptly at peribasal disc.

Description – Shell small, conical, with weakly convex whorls. Protoconch type A2, helicoidal, 1.75 whorls, with large nucleus (dp = 240 μm, hp = 240 μm, dn = 125 μm, tilted at about 105° to main shell axis). Teleoconch of 8-9 low whorls, separated by moderately deeply impressed weakly oblique suture. Sculpture of 18-20 sharp, straight, slightly opisthocline ribs, roughly half the width of their interspaces, crenulating adapical suture. Last whorl relatively low and broad, axials end abruptly at peribasal disc, base strongly depressed, smooth. Aperture subquadrate, columella straight, without fold.

Discussion – *Chemnitzia silvai* nov sp. is represented by numerous specimens showing remarkably little intraspecific variation. At first glance it is closely similar to *C. pseudocostellata* (Sacco, 1892). They both have the same shell profile composed of relatively low whorls, but *C. silvae* only attains about half the maximum height of *C. pseudocostellata*, and the ribs extend between the sutures as opposed to the ribs on later teleoconch whorls ending at a suprasutural cord, as they do in *C. pseudocostellata* (Sacco, 1892). Moreover, the ribs are stronger, less opisthocline, straighter, and terminate more abruptly at the peribasal disc in *C. silvai*. *Chemnitzia ligustica* (Sacco, 1892) is easily separated by its larger size, more convex whorls, and narrow sinuous ribs that do not stop as abruptly at the peribasal disc.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Chemnitzia* sp.**
Plate 101, fig. 1

Material and dimensions – Height 2.6 mm, width 670 μm. **VC**: NHMW 2019/0167/0709 (1).

Description – Shell of small for genus, tall, very slender, with regularly conical profile. Protoconch type B, with nucleus partially exposed (dp = 245 μm, hp = 180 μm, tilted at 130° to main shell axis), teleoconch of seven strongly convex whorls, separated by inclined suture, sculpture strong, prosocline axial ribs, 14 on penultimate whorl, roughly equal in width to their interspaces. Last whorls convex, 30% of total height, ribs ending abruptly at the periphery, but without forming well-defined basal disc, base smooth, imperforate. Aperture incomplete.

Discussion – In size and in having a type B protoconch this species is similar to *Turbonilla micans* (Monterosato, 1875) from which it differs in having much stronger ribs, convex whorls, and a well developed basal disc, placing it in the genus *Chemnitzia* d'Orbigny, 1840.

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

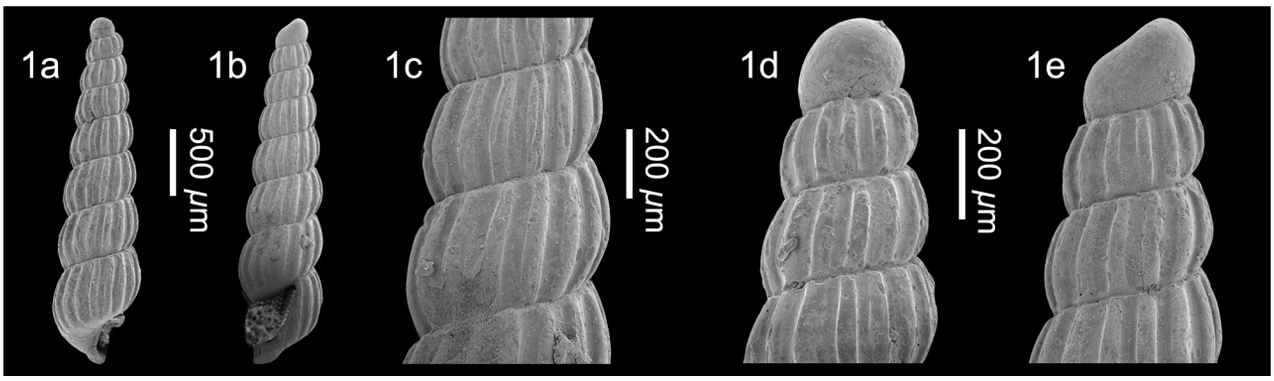

Plate 101. *Chemnitzia* sp.; 1. NHMW 2019/0167/0709, height 2.6 mm, width 670 μm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín Carretera, Estepona, lower Piacenzian, upper Pliocene.

Genus *Mormula* A. Adams, 1863

Type species – *Mormula rissoina* A. Adams, 1863 [= *Mormula philippiana* (Dunker, 1860)], by subsequent designation, Verrill & Bush, 1900, present-day, Japan.

1863 *Mormula* A. Adams, p. 1, 2.

Note – The genus *Mormula* A. Adams, 1863 includes species with a rather solid shell, axial ribs and deeply incised spiral grooves, and irregular broad varices on the later teleoconch whorls. Dall & Bartsch (1909) included lirations of the outer lip in their characterisation of the subgenus *Mormula* A. Adams, 1863. However, Higo *et al*. (2001, p. 135) published a figure of the type of *Mormula rissoina,* which shows a thickened lip without obvious lirations within, and a small apparently intorted protoconch. A. Adams (1863) descriptions of *Mormula* and *M. rissoina* do not mention lirations. The presence of lirations or nodes within the outer lip of turbonillids is an inconsistent character (Landau & LaFollette, 2015, p. 28).

***Mormula catherinae* (Glibert, 1949)**
Plate 102, figs 1-2

*1949a *Turbonilla* (*Mormula*) *catherinae* Glibert, p. 194, pl. 12, fig. 10.
1964 *Turbonilla* (*Mormula*) *catherinae* Glibert, 1949 – Brébion, p. 299, pl. 7, fig. 19.
2018 *Mormula* cf. *catherinae* (Glibert, 1949) – Bongiardino & Micali, p. 105, fig. 1I.
2020 *Mormula catherinae* (Glibert, 1949) – Landau *et al*., p. 331, pl. 61, figs 1-3.

Material and dimensions – Maximum height 10.1 mm, width 3.0 mm. **CO**: NHMW 2019/0167/0146 (1), NHMW 2019/0167/0147 (1). **VC**: NHMW 2019/0167/0148 (1). **VS**: NHMW 2019/0167/0246 (1).

Discussion – *Mormula catherinae* (Glibert, 1949) is immediately distinguished from all other turbonillids from Estepona by its relatively large size and very solid shell. The protoconch is of type A1 in French material, whereas specimens from Estepona shows a more inclined protoconch, falling within type B. The axial ribs are low, about 19-20 on the last whorl, separated by intervals narrower than the ribs cut by close-set regular spiral grooves. On the last whorl the ribs weaken rapidly over the base, but not abruptly as in the genus *Chemnitzia* d'Orbigny, 1840. The columella is short and straight and no fold is developed. The columellar and parietal calluses are continuous, forming a narrow callus rim.
The specimen from Estepona are not identical to those of France illustrated by Landau *et al*. (2020 pl. 61, figs 1-3) from the upper Miocene of northwestern France in having the protoconch more tilted tending to type B, resulting in the nucleus being more obscured. The spiral sculpture is a little weaker than in the French specimens, although the Estepona specimens are a little worn. Denticles are not present within the outer lip in the Estepona shells, but they are a variable character in *Mormula* A. Adams, 1863 species and probably only present in fully adult specimens. Despite these small differences, the specimens are otherwise so similar that we refrain from separating them at species level and merely highlight the differences.
Bongiardino & Micali (2018, fig. 1I) illustrated an incomplete shell from the upper Pliocene of Italy and assigned it to this species with some doubt due to the great geographic and stratigraphic gap between the Atlantic and Mediterranean specimens. However, the record of *M. catherinae* from the Atlantic upper Miocene of France (Landau *et al*., 2020) and this record from the upper Pliocene western Mediterranean of the Estepona Basin, Spain, partially close the stratigraphic gap and increase the geographic distribution of the species.

Distribution – Middle Miocene: Atlantic, Loire Basin, France (Glibert, 1949a). Upper Miocene: Atlantic, NW France (Millet, 1854, 1865; Brébion, 1964; Landau *et al*., 2020). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Bongiardino & Micali, 2018).

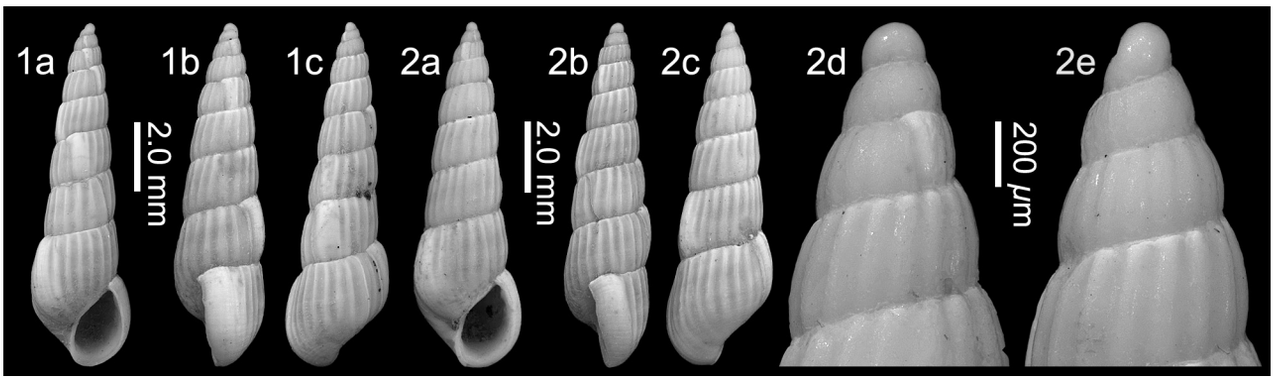

Plate 102. *Mormula catherinae* (Glibert, 1949); 1. NHMW 2019/0167/0146, height 9.9 mm, width 2.9mm; 2. NHMW 2019/0167/0149, height 10.1 mm, width 3.0 mm, 2d-e, detail of protoconch (digital images). Velerín conglomerates, Estepona, lower Piacenzian, upper Pliocene.

Genus *Pyrgisculus* Monterosato, 1884

Type species (by monotypy) – *Melania scalaris* Philippi, 1836 [= *Pyrgisculus jeffreysii* (Jeffreys, 1848)], present-day, Mediterranean.

1884 *Pyrgisculus* Monterosato, p. 88.

Note – Species in this group are characterised by having a scalate spire composed of strongly convex whorls, usually shouldered, the shoulder placed high, just below the suture, with strong lamellose axial ribs and fine spiral cords in the interspaces, subquadrate aperture, and lack of columellar fold (Monterosato, 1884, p. 88). Thiele (1929, p. 237) synonymised *Pyrgisculus* Monterosato, 1884 with *Dunkeria* Carpenter, 1857 (type species by subsequent designation, Bucquoy *et al*., 1898, *Chemnitzia paucilirata* Carpenter, 1857, present-day, Pacific Mexico). Until molecular phylogeny proves the monophylogeny of European genus *Pyrgisculus* with eastern Pacific *Dunkeria*, we prefer to consider them separate.

***Pyrgisculus jeffreysii* (Jeffreys, 1848)**
Plate 103, fig. 1

1836 *Melania scalaris* Philippi, p. 157 (*non* Spix *in* Wagner, 1827, *nec* Sowerby, 1829).
*1848 *Odostomia scalaris* var. *Jeffreysii* Jeffreys, p. 346.
1850 *Odostomia jeffreysii* Forbes & Hanley, p. 251.
1882 *Odostomia scalaris* Philippi – Bucquoy *et al*., p. 175, pl. 21, figs 4, 5.
1892a *Pyrgulina* (*Pyrgisculus*) *scalaris* (Phil.) – Sacco, p. 71.
1892a *Pyrgulina* (*Pyrgisculus*) *scalaris* var. *basidepressa* Sacco, p. 71, pl. 1, fig. 117.
1892a *Pyrgulina* (*Pyrgisculus*) *scalaris* var. *pliopercostata* Sacco, p. 71, pl. 1, fig. 118.
1892a *Pyrgulina* (*Pyrgisculus*) *scalaris* var. *subfasciolata* Sacco, p. 71, pl. 1, fig. 119.
1914 *Turbonilla* (*Pyrgisculus*) *scalaris* Phil. – Cerulli-Irelli, p. 276 [450], pl. 23 [55], figs 64-67.
1920 *Pyrgulina scalaris* (Philippi) – Harmer, p. 577, pl. 49, fig. 43.
1972b *Turbonilla* (*Dunkeria*) *scalaris* (Philippi, 1836) – Nordsieck, p. 131, pl. PVI, fig. 12.
1986 *Turbonilla jeffreysi* [*sic*] Forbes & Hanley, 1855 [*sic*] – Fretter *et al*., p. 640, figs 447- 449
1988 *Turbonilla jeffreysi* [*sic*] Forbes & Hanley, 1850 [*sic*] – Graham, p. 632, fig. 275.
1992 *Turbonilla jeffreysii* (Jeffreys, 1848) – Cavallo & Repetto, p. 162, fig. 460.
1994 *Turbonilla scalaris* (Ph.) – Tabanelli & Segurini, p. 13, pl. 2, fig. 12.
1996 *Turbonilla jeffreysii* (Jeffreys, 1848) – Peñas *et al*., p. 64, fig. 154.
1997 *Turbonilla jeffreysii* (Jeffreys, 1848) – Peñas & Rolán, p. 53, figs 131-132.
2001 *Turbonilla jeffreysii* (Jeffreys, 1848) – Cachia *et al*., p. 112, pl. 18, fig. 6.
2011 *Turbonilla jeffreysi* [*sic*] (Jeffreys, 1848) – Chirli & Micali, p. 82, pl. 30, figs 1-6.
2011 *Turbonilla jeffreysi* [*sic*] (Jeffreys, 1848) – Chirli & Linse, p. 207, pl. 81, fig. 3.
2011 *Turbonilla jeffreysi* [*sic*] (Jeffreys, 1848) – Hernández *et al*., p. 266, figs 90L-M.
2013 *Turbonilla jeffreysii* (Jeffreys, 1848) – Öztürk *&* Bitlis Bakir, p. 430, fig 17A-C.
2014 *Pyrgiscus jeffreysii* (Forbes & Hanley, 1850-1851) – Høisæter, p. 67, figs 6-11.
2014 *Dunkeria jeffreysii* (Forbes & Hanley, 1850) – Giannuzzi-Savelli *et al*., p. 84, fig. 273, appendix p. 32, 80.
2018 *Turbonilla jeffreysii* (Forbes & Hanley, 1850) – Trigo *et al*., p. 363, fig . 40.
2020 *Pyrgisculus jeffreysii* (Jeffreys, 1848) – Landau *et al*., p. 332, pl. 62, fig. 1.

Material and dimensions – Maximum height 6.0 mm, width 1.9 mm. **CO**: NHMW 2019/0167/0062 (1), NHMW 2019/0167/0063 (6). **VC**: NHMW 2019/0167/0064 (3). **VS**: NHMW 2019/0167/0247 (5). **EL**: NHMW 2019/0167/0115 (50+).

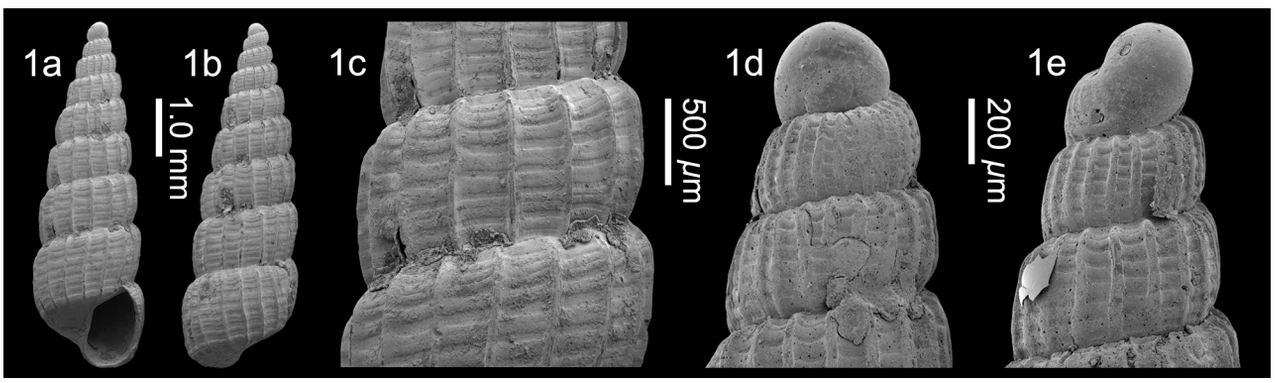

Plate 103. *Pyrgisculus jeffreysii* (Jeffreys, 1848); 1. NHMW 2019/0167/0062, height 6.0 mm, width 1.9 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Pyrgisculus jeffreysii* (Jeffreys, 1848) is characterised by it turriform, scalate profile, type B protoconch, just over two whorls, with the nucleus exposed (Estepona specimen; dp = 355 μm, hp = 295 μm, dn = 70 μm, tilted at about 135° to main shell axis), teleoconch of 6-7 shouldered whorls, separated by a deep undulating suture. Sculpture consists of 16-18 raised, sharp, narrow orthocline ribs separated by broad interspaces and 8-10 flattened spiral cords visible only in the interspaces. The cords are highly irregular in width and disposition, separated by narrow-relatively wide spiral grooves. The aperture is small, ovate, with a straight columella bearing the suggestion of a weak fold. The Estepona specimens are typical for the species, although the protoconch is slightly larger than that indicated by Peñas & Rolán (1997, p. 54) for the recent specimen from Angola (dp = 291 μm) and present day Mediterranean (dp = 270-300 μm), more similar to fossil specimens from Tuscany (dp = 325-330 μm; PM personal data).
As commented by Høisæter (2014, p. 68), the history of the name is complex. It has often been attributed to Forbes & Hanley (1850, p. 251), although the name was introduced earlier by Jeffreys (1848, p. 346).
There are no other congeners in the fossil or extant European faunas.

Distribution – Upper Miocene: Atlantic (Tortonian), NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Forli *et al*., 1999; Chirli & Micali, 2011). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0301); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992; Tabanelli & Segurini, 1994). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914), eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: English Channel, England (Harmer, 1920). Present-day: Atlantic southern British Isles (Nordsieck, 1972b; Fretter *et al*., 1986; Graham, 1988), northwestern Spain (Trigo *et al*., 2018), to Canary Islands (Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), and Angola (Peñas & Rolán, 1997), into Mediterranean (Bucquoy *et al*., 1882; Nordsieck, 1972b; Peñas *et al*., 1996; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk *&* Bitlis Bakir, 2013), more northern Atlantic records need to be verified (Høisæter, 2014).

Genus *Pyrgiscus* Philippi, 1841

Type species – *Melania rufa* Philippi, 1836, by subsequent designation Dall & Bartsch *in* Arnold, 1903, present-day, Mediterranean.

1841 *Pyrgiscus* Philippi, p. 50.
1841 *Ortostelis* Aradas & Maggiore, p. 27. Type species (by subsequent designation, Dall & Bartsch, 1909): *Melania rufa* Philippi, 1836, present-day, Mediterranean. Junior objective synonym of *Pyrgiscus* Philippi, 1841. Simultaneously published, *Pyrgiscus* given precedence by First Reviser's choice by Dall & Bartsch (1907, p. 504).
1884 *Pyrgostelis* Monterosato, p. 89. Type species (by subsequent designation, Crosse, 1885): *Melania rufa* Philippi, 1836, present-day, Mediterranean. Junior objective synonym of *Pyrgiscus* Philippi, 1841 and *Ortostelis* Aradas & Maggiore, 1841.

Note – Species in this group are characterised by having shells with sculpture composed of axial ribs and strongly incised spiral grooves. These species do not have varices or internal liration on the outer lip (Dall & Bartsch, 1909). Based on molecular data, Schander *et al*. (2003, fig. 2) suggested that *Pyrgiscus* appeared to be monophyletic.
This is the most distinctly characterised turbonillid genus. It is characterised by species with a variable number (about 6-20) more or less widely and regularly spaced spiral grooves visible in the axial interspaces. Today it is represented in the whole Mediterranean by the type species only, although future molecular studies may show this to be a species complex rather than a single taxon. Several further species occur in the eastern Atlantic from Norway (Høisaeter, 2014) to Southern Africa (Peñas *et*

al., 2014, *inter alia*). It is also present along the Western Atlantic Frontage (Abbott, 1974; Pimenta & Absalão, 2002; Guller & Zelaya, 2019), and eastern Pacific coast of the USA (Abbott, 1974) and Indo-Pacific (Saurin, 1959; Robba, 2013).

During the Neogene the genus was also widely distributed on both sides of the Atlantic, in the Caribbean (Landau & LaFollette, 2015) and Europe (Landau *et al*., 2020), and into the Mediterranean (Sacco, 1892b; Bartsch, 1955), and Paratethys (Sacco, 1892b: Boettger, 1906). According to Cossmann (1921) this genus is first reported from the Burdigalian (lower Miocene). This long geological history would support the position taken herein considering *Pyrgiscus* at full genus rank. This is also supported by molecular data that suggested that *Pyrgiscus* appeared to be monophyletic (Schander *et al*., 2003, fig. 2).

Chirli & Micali (2011, p. 102) discussed the variability found in the '*T. rufa*' species complex in Italian fossil assemblages, and as a consequence of ICZN (1999) Art. 45.6.4 elevated four of Sacco's (1982a, b) varieties to subspecies. The authors note at the end of the species discussion that all four subspecies co-occur at Poggio alle Fame and Melograni (Siena, Italy). Therefore, subspecific status is not acceptable, as subspecies cannot co-occur. In the Estepona material we recognise three of the four 'subspecies' discussed by those authors; *amplisuturata* is herein elevated to full species rank, *depressocostata* and *dertodecussata* are synonymised with *P. rufus* (Philippi, 1844), *exdensecostata* has not been found in Estepona and it is quite different, and therefore should possibly be elevated to full species rank. Problems in understanding the boundary between intraspecific variability and species separation in this genus are well known for Pliocene fossil material from St. Petersburg, Florida (Bartsch, 1955) and several species described from West Africa (see Peñas *et al*, 2014 for summary).

***Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946)**
Plate 104, fig. 1

*1946 *Turbonilla Abrardi* Fischer-Piette & Nicklès, p. 56, 59-60, fig. 17.

1996 *Turbonilla joubini* Dautzenberg, 1913 [*sic*] – Peñas *et al*., 64, figs 157, 160 [*non T. joubini* Dautzenberg, 1912].

1997 *Turbonilla abrardi* Fischer y Nicklès, 1946 – Peñas & Rolán, p. 60, figs 161-166, 173.

2014 *Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946) – Giannuzzi-Savelli *et al*., p. 86, fig. 285, appendix p. 33, 81.

2014 *Turbonilla abrardi* Fischer-Piette & Nicklès, 1946 – Peñas *et al*., p. 186, figs 26L-M.

Material and dimensions – Maximum height 3.6 mm, width 1.0 mm. **EL**: NHMW 2019/0167/0606 (1), NHMW 2019/0167/0607 (9).

Discussion – *Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946) is characterised by its type A1 tending to B protoconch (Estepona specimen; dp = 305 μm, hp = 225 μm, dn = 50 μm, tilted at about 120° to main shell axis), slightly smaller than the 340 μm described by Peñas & Rolán (1997, p. 62) and Giannuzzi-Savelli *et al*. (2014, p. 33, 81) for extant specimens. The teleoconch is subconical in profile, composed of about six convex whorls separated by a deep suture, about 23 slightly flexuose, orthocline axial ribs, narrower than their interspaces, that do not persist onto the base, about ten spiral grooves visible in the axial interspaces, and a subrhomboidal aperture without a columellar fold. This species is similar to *P. rufus* (Philippi, 1836) and *P. crenatus* (Brown, 1827), but is smaller, with a more cyrtoconoid profile, more convex whorls and a greater number of grooves in the axial interspaces. As far as we are aware this is the first fossil record of this species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa Morocco to Angola (Fischer-Piette & Nicklès, 1946; Peñas & Rolán, 1997; Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 1996; Giannuzzi-Savelli *et al*., 2014).

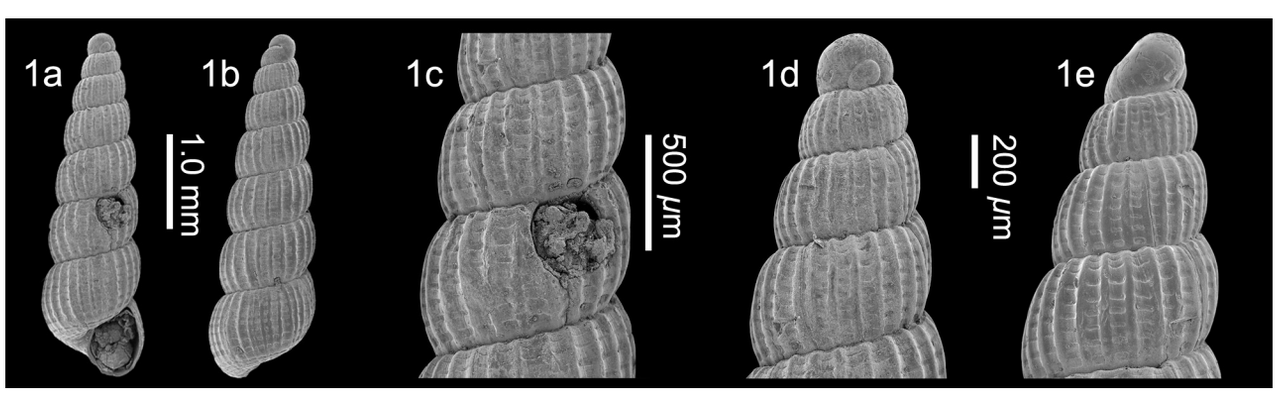

Plate 104. *Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946); 1. NHMW 2019/0167/0606, height 3.6 mm, width 1.0 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

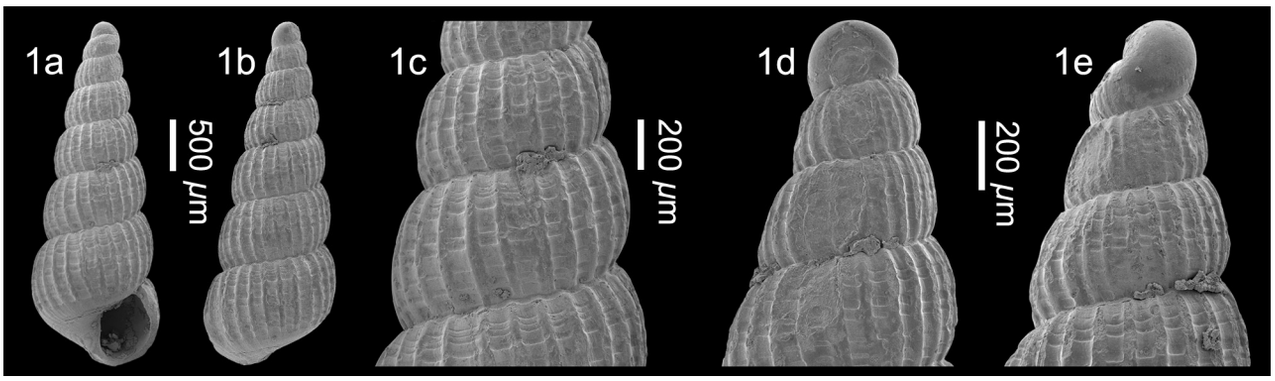

Plate 105. *Pyrgiscus amplisuturatus* (Sacco, 1892); 1. NHMW 2019/0167/0516, height 3.4 mm, width 1.2 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

***Pyrgiscus amplisuturatus* (Sacco, 1892)**
Plate 105, fig. 1

1892a	*Turbonilla* (*Pyrgostelis*) *rufa* var. *amplisuturata* Sacco, pl. 2, fig. 121.
*1892b	*Turbonilla* (*Pyrgostelis*) *rufa* var. *amplisuturata* Sacco, p. 4.
2011	*Turbonilla rufa amplisuturata* Sacco, 1892 – Chirli & Micali, p. 102, pl. 36, figs 1-5.

Material and dimensions – Maximum height 3.4 mm, width 1.2 mm. **CO**: NHMW 2019/0167/0530 (2). **VC**: NHMW 2019/0167/0845 (4). **EL**: NHMW 2019/0167/0516 (1), NHMW 2019/0167/0517 (4).

Discussion – Originally described as a variety of *Pyrgiscus rufus* (Philippi, 1836), it differs in having strongly convex whorls, separated by a deeper suture, and a greater number of axial ribs (about 30 on the last whorl vs 18-24). Both forms have a type B protoconch of similar shape and number of whorls, but slightly smaller than the extant specimen of *P. rufus* from Sahara (*P. amplisuturatus* Estepona specimen; dp = 260 μm, hp = 220 μm, tilted at about 137° to main shell axis vs dp = 300 μm; Peñas & Rolán, 1997, fig. 195), and considerably smaller than *P. rufus* from Estepona (dp = 355 μm, hp = 325 μm, dn = 75 μm, see below). In view of difference in the shape of the whorls, the greater number of ribs and the smaller protoconch we prefer to consider them separate taxa. Chirli & Micali (2011, p. 102) proposed subspecific status for this form, but considering that in Estepona it is found together with typical *P. rufus* in the Velerín conglomerates and El Lobillo deposits, we prefer to consider them distinct at full species rank.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: central Mediterranean, Italy (Sacco, 1892b); western Mediterranean, Estepona Basin, Spain (this paper).

***Pyrgiscus bilineatus* (Seguenza, 1876)**
Plate 106, figs 1-2

*1876	*Turbonilla bilineata* Seguenza, p. 14.
1892a	*Turbonilla* (*Pyrgostelis*) *bilineata* (Segu.) – Sacco, pl. 2, fig. 125.
1892b	*Turbonilla* (*Pyrgostelis*) *bilineata* (Segu.) – Sacco, p. 7.
1914	*Turbonilla densecostata* Phil. – Cerulli-Irelli, p. 270 [444], pl. 23 [55], figs 41-43.
1969	*Turbonilla* (*Pyrgostelis*) *bilineata* Seguenza – Fekih, p. 41, pl. 7, fig. 8.
1976	*Turbonilla* (*Pyrgiscus*) *bilineata* Seguenza, 1876 – Pavia, p. 161, pl. 11, figs 20-23.
1992	*Turbonilla* (*Pyrgostelis*) *bilineata* (Seguenza, 1876) – Cavallo & Repetto, p. 160, fig. 457.
2010	*Turbonilla bilineata* Seguenza (1876) – Sosso & Dell'Angelo, p. 52, 67, middle row right fig.
2011	*Turbonilla bilineata* Seguenza G. 1876 – Chirli & Micali, p. 73 (pl. 26, figs 7-12; *lapsus*), corrected to pl. 26, figs 13-18 (*cum syn*.).
2011	*Turbonilla bilineata* Seguenza G. 1876 – Chirli & Linse, p. 204, pl. 80, fig. 1.

Material and dimensions – Maximum height 5.0 mm, width 1.0 mm. **CO**: NHMW 2019/0167/0263 (4). **VC**: 2019/0167/00165 (1), NHMW 2019/0167/00166 (5). **EL**: NHMW 2019/0167/0433 (50+). NHMW 2019/0167/0734 (1).

Discussion – *Pyrgiscus bilineatus* (Seguenza, 1876) is characterised by its cyrtoconoid profile, composed of 9-10 weakly convex whorls (fully adult), separated by an impressed weakly undulating suture, and A1 tending to B type protoconch composed of 1.75 whorls (Estepona specimen; dp = 280 μm, hp = 260 μm, dn = 85 μm, tilted at about 120° to main shell axis). Later whorls are slightly pinched adapically in fully adult specimens. Sculpture consists of 20-24 narrow, weakly opisthocline to prosocline ribs, about half to one-third width of their interspaces that persist onto the base, and numerous irregular spiral grooves in the axial interspaces that also persist onto

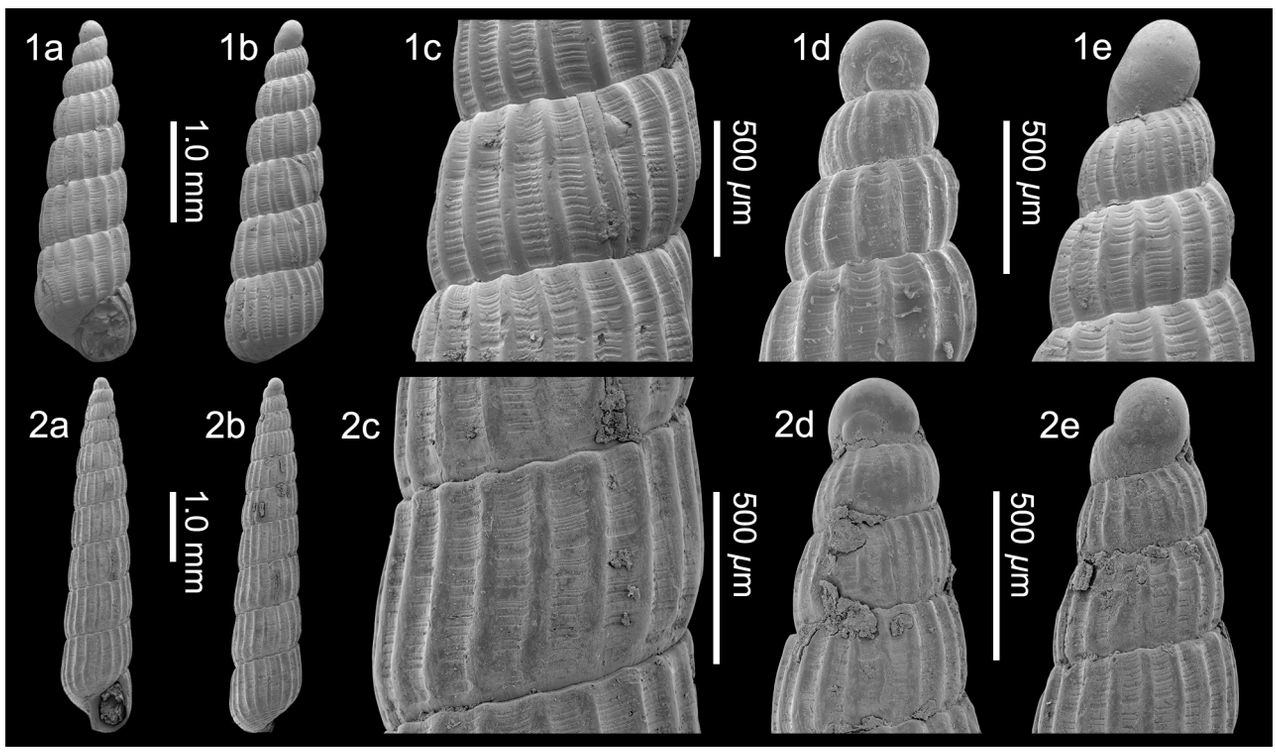

Plate 106. *Pyrgiscus bilineatus* (Seguenza, 1876); 1. NHMW 2019/0167/0165, height 3.4 mm, width 1.0 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch. Velerín carretera, Velerín. 2. NHMW 2019/0167/0734, height 5.0 mm, width 1.0 mm, 2c, detail of teleoconch sculpture penultimate whorl, 2d-e, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

the base. Two spiral grooves (one near center of the whorl and another near the abapical suture) are larger than the others, and characterise this species. For comparison see under *P. bonellii* (Pavia, 1976).

This species is very similar to *Striopyrgus hybridus* Bartsch, 1955 from the Pliocene of St. Petersburg (Florida) and, similarly, shows a remarkable variability. Bartsch (1955, p. 7) described the genus *Striopyrgus* separating it from *Pyrgiscus* Philippi, 1841 in the spiral sculpture consisting of "*cords and incised lines*" instead of "*cords*" only. A similar sculpture is seen in *P. inaequabilis* Peñas & Rolán, 1997 and *Pyrgiscus kerstinae* Schander, 1994 (see below). *Turbonilla sanctorum* Dall & Bartsch, 1909, and *T. superba* Dall & Bartsch, 1909, both from the Gulf of California also show a similar sculpture. Anyway as the spiral sculpture of *Pyrgiscus* species present in West Africa and both American coasts is very variable, we are not convinced that the indicated difference in sculpture is enough to justify the placement in a separate genus.

Distribution – Lower Pliocene: central Mediterranean, Italy (Sacco, 1892b; Pavia, 1976; Crovato & Micali, 1992b; Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892b; Cavallo & Repetto, 1992; Sosso & Dell'Angelo, 2010). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914), eastern Mediterranean, Rhodes (Chirli & Linse, 2011).

***Pyrgiscus bonellii* (Pavia, 1976)**
Plate 107, fig. 1

1892a	*Turbonilla* (*Pyrgostelis*) *columnaris* (Bon.) – Sacco, pl. 2, fig. 131 (*non* Pantanelli, 1884).
1892b	*Turbonilla* (*Pyrgostelis*) *columnaris* (Bon.) – Sacco, p. 6 (*non* Pantanelli, 1884).
*1976	*Turbonilla* (*Pyrgiscus*) *bonellii* Pavia, p. 162, pl. 11, figs 24-27 (*nom. nov. pro T.* (*P.*) *columnaris* Sacco, 1892, *non* Pantanelli, 1884).
1984	*Pyrgostelis bonellii* Pavia, 1976 – Ferrero Mortara *et al*., p. 86, pl. 13, fig. 3.
1992	*Turbonilla bonellii* Pavia, 1976 – Cavallo & Repetto, p. 162, fig. 458.
2008	*Turbonilla bonellii* Pavia, 1975 [*sic*] – Chirli & Richard, p. 77, pl. 15, fig. 7.
2011	*Turbonilla bonellii* Pavia, 1976 – Chirli & Micali, p. 74, (pl. 26, figs 13-18, pl. 27, fig. 1; *lapsus*), corrected to pl. 27, figs 1-7 (*cum syn*.).
2011	*Turbonilla bonellii* Pavia, 1976 – Chirli & Linse, p. 205, pl. 80, fig. 2.
2018	*Pyrgiscus bonellii* (Pavia, 1972 [*sic*]) – Brunetti & Cresti, p. 114, fig. 501.
non 1920	*Turbonilla* (*Pyrgolidium*) *columnaris* (Bonelli) – Harmer, p. 575, pl. 49, fig. 40.

Material and dimensions – Maximum height 5.7 mm, width 1.6 mm. **CO**: NHMW 2019/0167/0215 (3). **VC**:

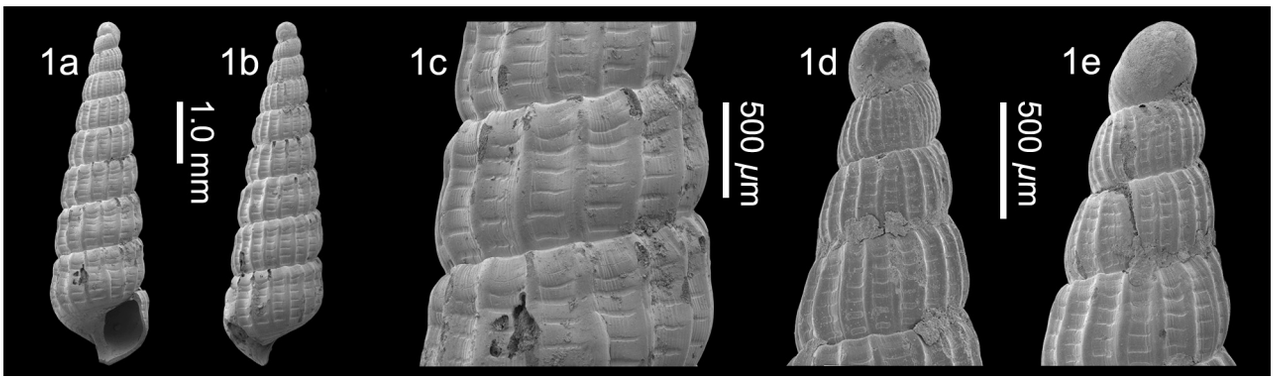

Plate 107. *Pyrgiscus bonellii* (Pavia, 1976); 1. NHMW 2019/0167/0091, height 5.7 mm, width 1.6 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

NHMW 2019/0167/0091 (1), NHMW 2019/0167/0092 (9). **VS**: NHMW 2019/0167/0854 (1). **EL**: NHMW 2019/0167/0437 (1).

Discussion – *Pyrgiscus bonellii* (Pavia, 1976) is characterised by its heterostrophic A1 type protoconch composed of little over two whorls (Estepona specimen; dp = 350 µm, hp = 320 µm, tilted at about 118° to main shell axis). The original description states the apical angle as being 100°, although the Estepona specimens and those illustrated by Chirli & Micali (2011) both have a greater angle close to 118°. The teleoconch is composed of 7-9 whorls, early whorls convex, later whorls with 'pinched' concave adapical half, swollen convex adapical half, separated by a deeply impressed suture. Sculpture of 14-20 narrow, slightly flexuous orthocline ribs that persist over the base and narrow, crowded, irregular spiral grooves in the interspaces that also persist onto the base. It differs from *Pyrgiscus rufus* (Philippi, 1844) in whorl profile, pinched abapically and slightly swollen above the suture, in having a smaller protoconch, and most specimens have fewer axial ribs (14-20 vs 18-24), although there is some overlap. *Pyrgiscus bilineatus* (Seguenza, 1876), with which it co-occurs in the Estepona deposits (see above), differs in having the whorls less pinched adapically, more numerous axial ribs, and more crowded spiral grooves in the interspaces.

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Crovato & Micali, 1992b; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), Roussillon Basin, France (Chirli & Richard, 2008); central Mediterranean, Italy (Sacco, 1892b; Cavallo & Repetto, 1992; Ferrero Mortara *et al*., 1984). Lower Pleistocene: eastern Mediterranean, Rhodes (Chirli & Linse, 2011).

Pyrgiscus coseli (Peñas & Rolán, 2002)

Plate 108, fig. 1

*2002	*Turbonilla coseli* Peñas & Rolán, p. 46, figs 97-101.
2014	*Turbonilla coseli* Peñas & Rolán, 2002 – Peñas & Rolán, p. 188, figs 27I-J.

Material and dimensions – Maximum height 4.7 mm, width 1.3 mm. **EL**: NHMW 2019/0167/0818 (1), NHMW 2019/0167/0819 (10). **VS**: NHMW 2019/0167/0852 (2).

Discussion – *Pyrgiscus coseli* (Peñas & Rolán, 2002)

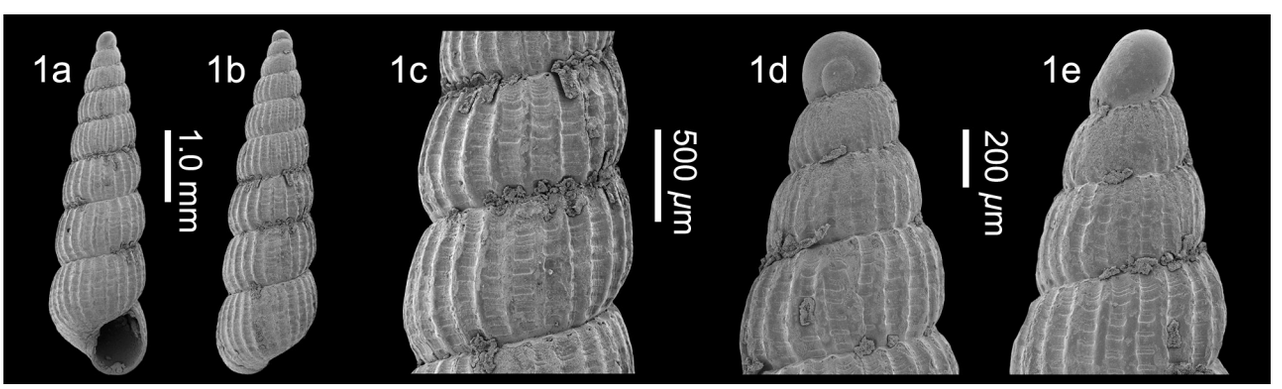

Plate 108. *Pyrgiscus coseli* (Peñas & Rolán, 2002); 1. NHMW 2019/0167/0818, height 4.7 mm, width 1.3 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

is characterised by its type B protoconch of about 1.75 whorls, with the nucleus exposed. The protoconch in the Estepona specimens (dp = 280 μm, hp = 255 μm, tilted at about 120° to main shell axis) is somewhat smaller than that of extant specimens from the Congo (dp = 330 μm, *fide* Peñas & Rolán, 2002, p. 46), but otherwise similar in the number of whorls exposed and inclination. The teleoconch consists of 6-7 convex whorls separated by a deeply impressed linear suture, sculpture of about 20 narrow, elevated, weakly opisthocline ribs, twice the width of their interspaces, on the last whorl stopping relatively abruptly at the base, and about ten grooves and cords of irregular width in the axial interspaces with a further ten spirals over the base. The aperture is subrhomboidal and the columella vertical, without a fold.

Several similar *Pyrgiscus* species occur in the Estepona assemblage: *P. abrardi* (Fischer-Piette & Nicklès, 1946) has a more solid shell, the protoconch angle is greater resulting in the nucleus being more obscured, the ribs are lower, slightly greater in number, and equal in width to their interspaces, and the grooves are similar in number, but narrower.

P. rufescens (Forbes, 1846) has a more cylindrical profile, with more convex whorls, the axial ribs are more lamellose, and has fewer spiral cords of equal strength (6 vs 10), *P. joubini* (Dautzenberg, 1912) is narrower, taller spired, with less convex whorls and deeper suture, the axial ribs are orthocline and lower, and the spirals are narrower and regular (Peñas & Rolán, 2002, p. 46). This is the first fossil record for the species

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Senegal (Peñas *et al*., 2014), Mauritania and Congo (Peñas & Rolán, 2002).

***Pyrgiscus giganteoastensis* (Sacco, 1892)**
Plate 109, fig. 1

1892a *Turbonilla* (*Pyrgostelis*) *rufa* var. *giganteoastensis* Sacco, pl. 2, fig. 127.
*1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *giganteoastensis* Sacco, p. 6.
2018 *Pyrgiscus* sp. A. – Brunetti & Cresti, p. 114, fig. 507.

Material and dimensions – Maximum height 11.4 mm, width 2.9 mm (fragment suggesting 14-15 mm height). **CO**: NHMW 2019/0167/0214 (5). **VC**: NHMW 2019/0167/0195 (1), NHMW 2019/0167/0196 (2 + 2 fragments).

Discussion – *Pyrgiscus giganteoastensis* (Sacco, 1892) is characterised by its large (one fragment from the Velerín carretera assemblage suggests 14-15 mm height), slender, conical shell, heterostrophic type A1 protoconch, teleoconch composed of 9-10 whorls, early whorls convex, later whorls with frustate, separated by a moderately deeply impressed suture. Sculpture of 26-30 narrow, weakly prosocline ribs that persist over the base and narrow, crowded, irregular spiral microsculpture in the interspaces consisting of irregularly spaced spiral grooves of variable width that also persist onto the base. Axials predominate over all the shell surface, except for the base where spirals become predominant. Originally described as a variety of *P. rufus* (Philippi, 1836), it clearly differs from that species in being larger, in having a more conical shell, the diameter increasing steadily abapically, and in having more numerous axial ribs (28-30 vs 18-24). Moreover, the protoconch is of type A1 as opposed to type B in *P. rufus*. The large turbonillid from the lower Pliocene of Italy illustrated by Brunetti & Cresti (2018, fig. 507; height 15.2 mm) as *Pyrgiscus* sp. A represents this species.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2014). Upper Pliocene: central Mediterranean, Italy (Sacco, 1892b); western Mediterranean, Estepona Basin, Spain (this paper).

***Pyrgiscus inaequabilis* (Peñas & Rolán, 1997)**
Plate 110, fig. 1

?1892a *Turbonilla* (*Pyrgostelis*) *bilineata* var. *subalineata* Sacco, pl. 2, fig. 137.

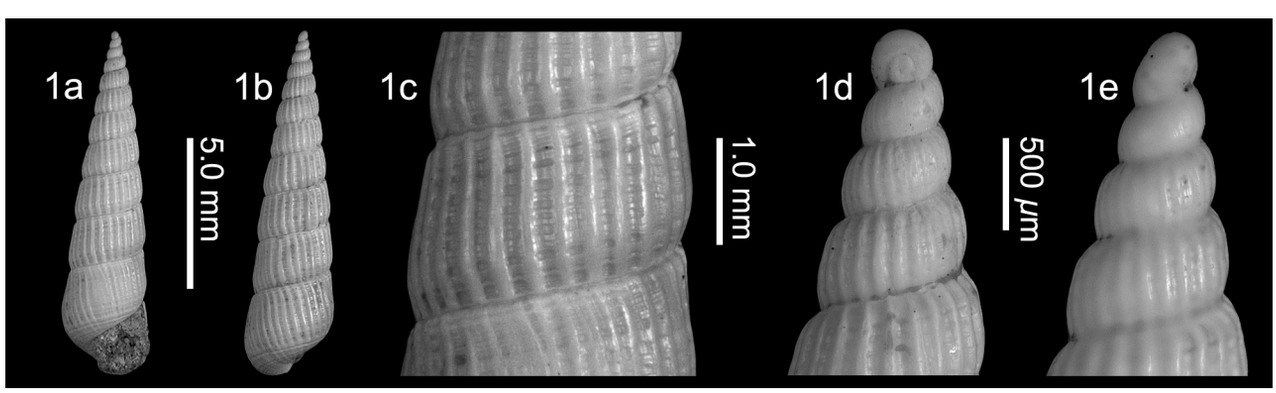

Plate 109. *Pyrgiscus giganteoastensis* (Sacco, 1892); 1. NHMW 2019/0167/0195, height 11.4 mm, width 2.9 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (digital image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

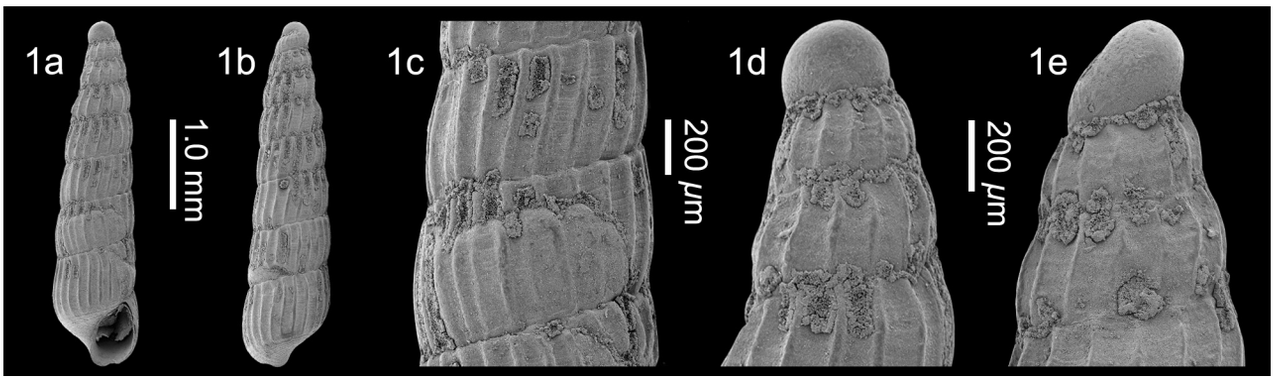

Plate 110. *Pyrgiscus inaequabilis* (Peñas & Rolán, 1997); 1. NHMW 2019/0167/0540, height 3.9 mm, width 965 µm, 2c, detail of teleoconch sculpture last two spire whorls, 2d-e detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

?1892b *Turbonilla* (*Pyrgostelis*) *bilineata* var. *subalineata* Sacco, p. 8.
*1997 *Turbonilla inaequabilis* Peñas & Rolán, p. 66, figs 186-190.

Material and dimensions – Height 3.9 mm, width 965 µm. **CO**: NHMW 2019/0167/0540 (1).

Discussion – *Pyrgiscus inaequabilis* (Peñas & Rolán, 1997) is characterised by its tall, slender subcylindrical shell, the early teleoconch whorls pupoid in profile, type B protoconch, with the nucleus only half exposed (Estepona specimen; dp = 295-310 µm, hp = 240-250 µm, tilted at about 135° to main shell axis), teleoconch composed of eight very weakly convex whorls, separated by a superficial, finely undulating suture, sculpture of low, narrow, orthocline to slightly opisthocline, sinuous ribs, separated by interspaces 2-3 times the width of the ribs, about 23 on the penultimate whorl, with fine spiral threads in the interspaces. In the extant specimens one groove mid-whorl and two grooves at the base are slightly larger than the others. This is not so clear in the imperfectly preserved fossil specimen. Similarly, the fine axial growth lines described for the type material (Peñas & Rolán, 1997, fig. 190) are not seen in the fossil specimen. The protoconch in the Estepona specimen is also slightly larger than the measurements given for the type (dp = 310 µm vs dp = 272 µm; *fide* Peñas & Rolán, 1997, p. 66). The base is imperforate and bears 7-8 spiral striae.
This might be the same species as that described as *Turbonilla* (*Pyrgostelis*) *bilineata* var. *subalineata* Sacco, 1892 from the Pliocene of Italy. However, the original description and illustration (Sacco, 1892a, b) does not adequately characterise that species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: West Africa, Angola (Peñas & Rolán, 1997).

***Pyrgiscus jaapmulderi* nov. sp.**
Plate 111, fig. 1

Type material – Holotype NHMW 2019/0167/0536, height 2.5 mm, width 960 µm; paratype 1 NHMW 2019/0167/0537, height 2.4 mm, width 950 µm.

Other material – Maximum height 2.5 mm, width 960 µm. **EL**: NHMW 2019/0167/0589 (45).

Type locality – El Lobillo, Estepona, Spain.

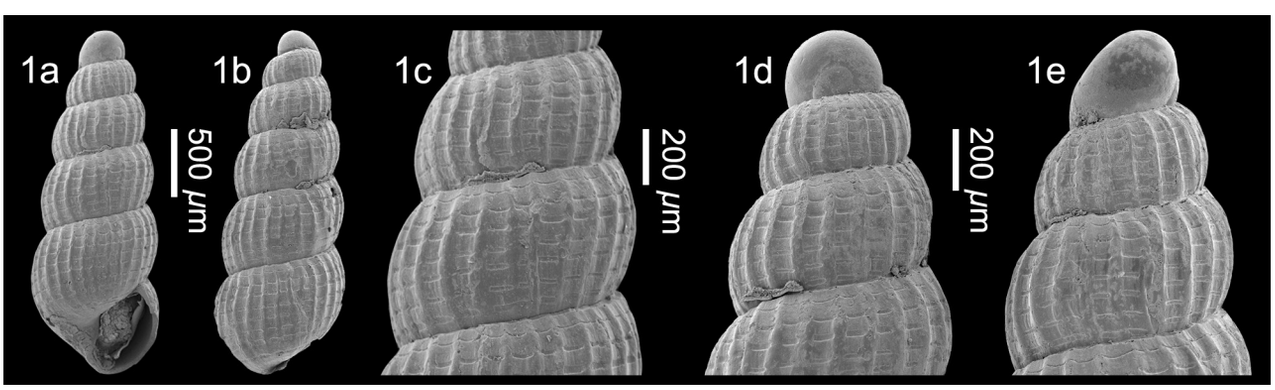

Plate 111. *Pyrgiscus jaapmulderi* nov. sp.; 1. **Holotype** NHMW 2019/0167/0536, height 2.5 mm, width 960 µm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Jaap Mulder, son of Henk Mulder, in recognition of Henk's enormous contribution in the preparation of this monograph. *Pyrgiscus* gender masculine.

Diagnosis – *Pyrgiscus* species of small size, relatively squat, type B protoconch, five strongly convex teleoconch whorls, bearing narrow orthocline ribs, 24 on penultimate whorl, deep spiral grooves in axial interspaces, seven on penultimate whorl, one row grooves mid-base.

Description – Shell small, relatively squat, with pupoid-subconical profile. Protoconch type B, nucleus almost completely exposed (dp = 330 μm, hp = 290 μm, dn = 70 μm, tilted at about 123° to main shell axis). Teleoconch of five strongly convex whorls, with periphery just below mid-whorl, separated by deeply impressed suture. Sculpture of close-set, narrow orthocline axial ribs, 24 on penultimate whorl, about half width of their interspaces, with irregular, deep spiral grooves in interspaces, seven on penultimate whorl. Last whorl 46% total height, regularly convex, ribs weakening over base; base not sharply delimited, imperforate, bearing one row spiral grooves mid-base. Aperture ovate, 24% total height, outer lip evenly rounded, columella straight, without fold.

Discussion – *Pyrgiscus jaapmulderi* nov. sp. is characterised by its strongly convex whorls and the single row of grooves placed mid-base. It is most similar to *P. amplisuturatus* (Sacco, 1892), as both have strongly convex whorls, but *P. jaapmulderi* is squatter, with a more pupoid profile, and a wider apical angle. The basal sculpture is also different: *P. amplisuturatus* bears 7-8 very fine continuous spiral grooves on the abapical half of the base, whereas *P. jaapmulderi* bears a single row of interrupted grooves mid-base. *Pyrgiscus joubini* (Dautzenberg, 1912) (see below) has less convex spire whorls than *P. jaapmulderi*, fewer broader axial ribs, and, like *P. amplisuturatus*, has continuous narrow spiral grooves on the abapical half of the base.

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

***Pyrgiscus joubini* (Dautzenberg, 1912)**
Plate 112, figs 1-2

*1912	*Turbonilla joubini* Dautzenberg, p. 65, pl. 2, figs 43, 44.
1997	*Turbonilla joubini* Dautzenberg, 1913 [*sic*] – Peñas & Rolán, p. 70, figs 172, 199-203.
non 1996	*Turbonilla joubini* Dautzenberg, 1913 [*sic*] – Peñas *et al*., p. 64, figs 157, 160 [= *Pyrgiscus abrardi* (Fischer & Nicklès, 1946)].

Material and dimensions – Maximum height 3.3 mm,

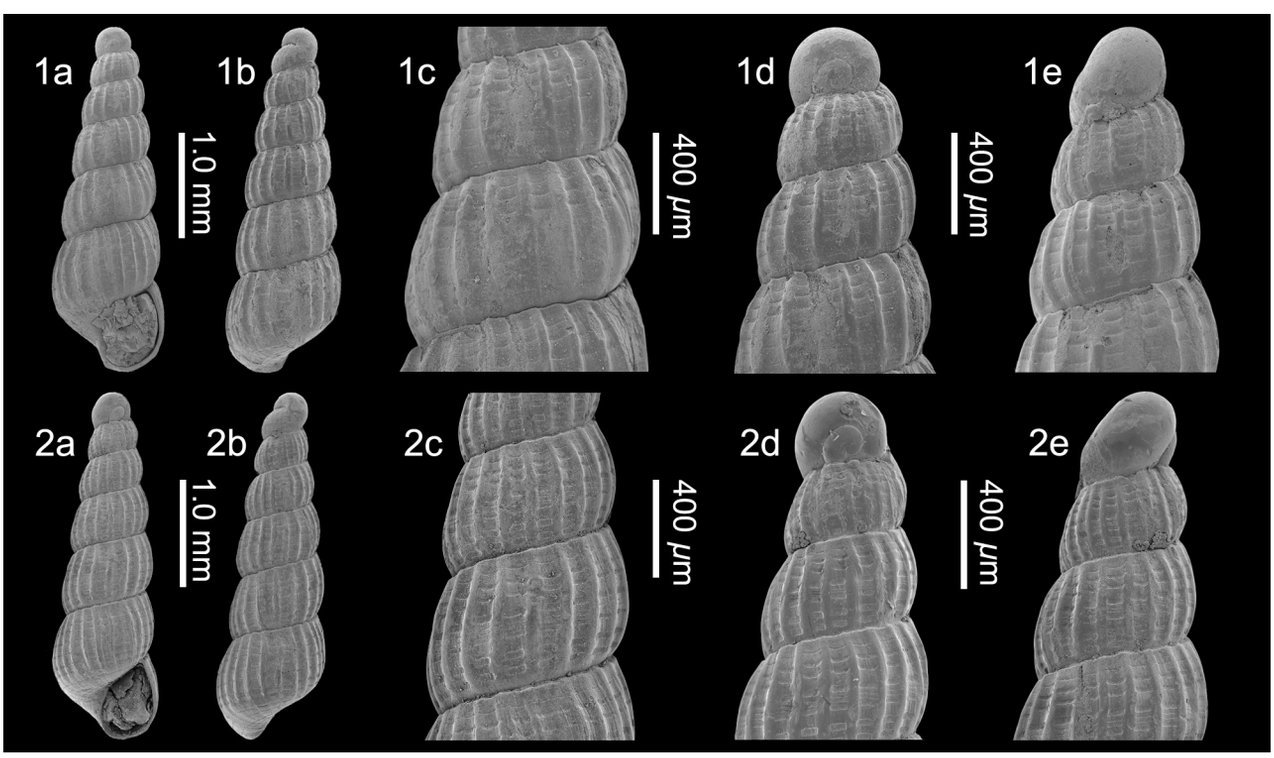

Plate 112. *Pyrgiscus joubini* (Dautzenberg, 1912); 1. NHMW 2019/0167/0466, height 3.3 mm, width 1.0 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of of protoconch. Velerín carretera, Velerín. 2. NHMW 2019/0167/0612, height 3.2 mm, width 1.0 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of of protoconch (SEM images). El Lobillo. Estepona, lower Piacenzian, upper Pliocene.

width 1.0 mm. **VC**: NHMW 2019/0167/0466 (1), NHMW 2019/0167/0467 (1). **EL**: NHMW 2019/0167/0612 (1), NHMW 2019/0167/0613 (1).

Discussion – *Pyrgiscus joubini* (Dautzenberg, 1912) is closely similar to *P. rufus* (Philippi, 1836), but differs in being less slender, having more convex whorls separated by a deeper suture, and in having more regular grooves in the axial interspaces. The specimen illustrated from Estepona is not fully adult, with only five teleoconch whorls at a height of 3.3 mm. The specimen from Angola illustrated by Peñas & Rolán (1997, fig. 200) has ten teleoconch whorls (height 6.1 mm), but is comparable in height at the five-whorl stage. The protoconch of the present-day shells is of type A1, consisting of just over two whorls, with the nucleus completely exposed, although in the Estepona specimens the protoconch is slightly more tilted falling into type B (Estepona specimen; dp = 330-340 μm, hp = 320-325 μm, dn = 60-90 μm, tilted at about 115° to main shell axis), and slightly larger than the dimension given by Peñas & Rolán (1997, p. 70) for a specimen from Angola (dp = 315 μm). We consider this difference to fall within intraspecific variability. In any case, the figure from which Peñas & Rolán (1997, fig. 201) calculated the diameter looks a little rotated, which would reduce the protoconch diameter. The axial growth lines are not as evident as they are in the West African specimen illustrated by Peñas & Rolán (1997, fig. 202), because the surface is a little abraded in the fossil specimen. The regularly convex whorls also separate this species from two other Estepona congeners: *P. bilineatus* (Seguenza, 1876) and *P. giganteoastensis* (Sacco, 1892), the latter is also much larger, and *P. bonellii* (Pavia 1976) has slightly coronate late teleoconch whorls.

Distribution – Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0299); western Mediterranean, Estepona Basin, S. Spain (this paper). Present-day: West Africa, Ghana, Angola (Peñas & Rolán, 1997), Mauritania (Peñas & Rolán, 2002).

***Pyrgiscus kerstinae* (Schander, 1994)**
Plate 113, figs 1-2

*1994	*Turbonilla kerstinae* Schander, p. 54, figs 8f, 14 j, k, 15k.
1997	*Turbonilla kerstinae* Schander, 1994 – Peñas & Rolán, p. 48, figs 114, 115.
2014	*Turbonilla kerstinae* Schander, 1994 – Peñas *et al*., p. 192, figs 28L-M.

Material and dimensions – Maximum height 3.3 mm, width 1.0 mm. **EL**: NHMW 2019/0167/0640-0641 (2), NHMW 2019/0167/0642 (6).

Discussion – *Pyrgiscus kerstinae* (Schander, 1994) is characterised by its stout cyrtoconoid shell with a type A1 tending to B protoconch, composed of at least two whorls with most of the apex obscured (Estepona speci-

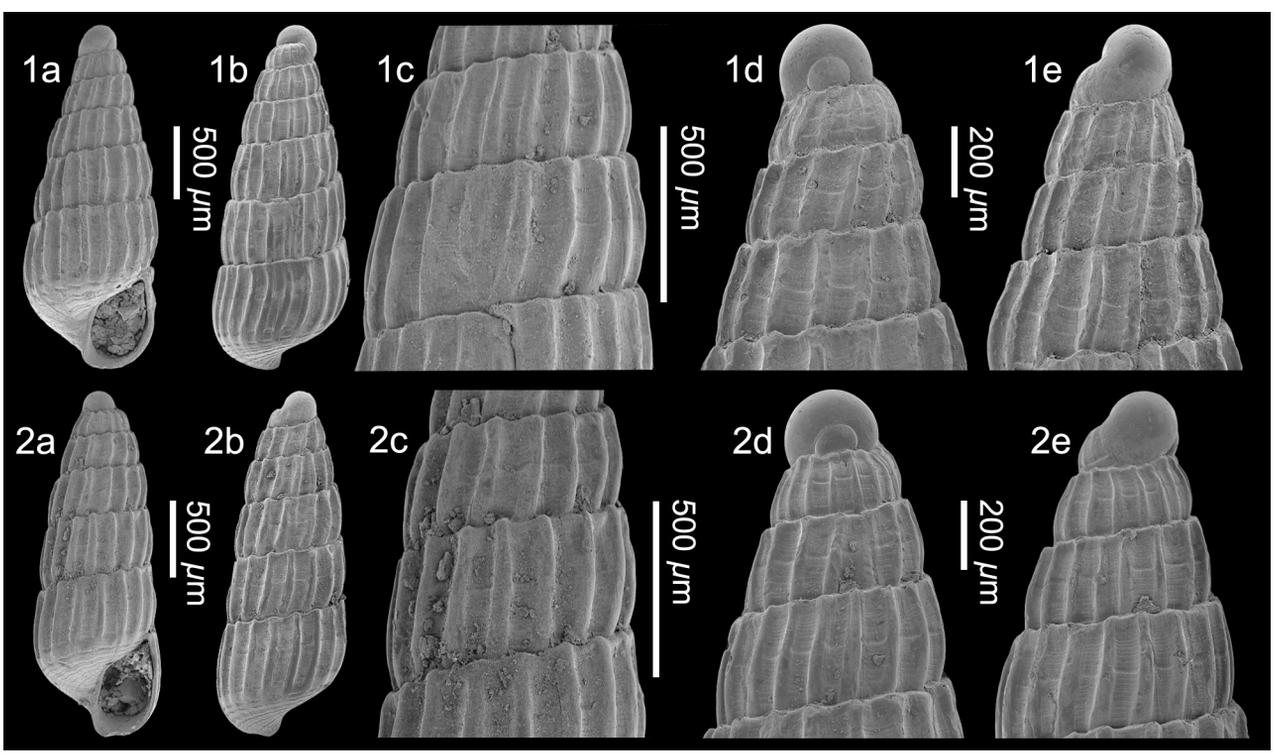

Plate 113. *Pyrgiscus kerstinae* (Schander, 1994); 1. NHMW 2019/0167/0640, height 2.4 mm, width 925 μm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of of protoconch. Velerín carretera, Velerín. 2. NHMW 2019/0167/0641, height 2.3 mm, width 825 μm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of of protoconch (SEM images). El Lobillo. Estepona, lower Piacenzian, upper Pliocene.

men; dp = 260-280 μm, tilted at about 117-120° to main shell axis). The diameter is within the range given for the present-day specimens, but possibly slightly more tilted (dp = 280 μm, tilted at 110° *fide* Schander, 1994, p. 54). The teleoconch is composed of five weakly convex whorls with a slight constriction just below the suture, sculptured by about 18 strong orthocline to slightly opisthocline axial ribs, slightly narrower than their interspaces. Numerous fine spiral grooves are present in the axial interspaces, of which two are wider and more visible; one placed at the subsutural constriction, the lower mid-whorl. Both the axial and spiral sculpture continue over the base. The Estepona specimens are slightly different in lacking the subsutural major groove. However, they fit closely in size, profile and protoconch characters, and we consider them conspecific. For comparison with related species, see Schander (1994, p. 55).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Mauritania to Angola (Schander, 1994; Peñas & Rolán, 1997; Peñas *et al*., 2014).

***Pyrgiscus pablopenasi* (Peñas, Rolán & Swinnen, 2014)**
Plate 114, fig. 1

*2014 *Turbonilla pablopenasi* Peñas, Rolán & Swinnen, p. 200, figs 31D-G.

Material and dimensions – Height 3.0 mm, width 905 μm. **VC**: NHMW 2019/0167/0507 (1), NHMW 2019/0167/0593 (2).

Discussion – *Pyrgiscus pablopenasi* (Peñas, Rolán & Swinnen, 2014) is characterised by its small size, moderately tall and slender, conical to subcylindrical spire, type A1 protoconch of about two whorls, with the nucleus completely exposed (Estepona specimen: dp = 300 μm, hp = 265 μm, dn = 80 μm, tilted at about 120° to main shell axis), teleoconch of up to nine whorls, early whorls strongly convex, flattening somewhat abapically, separated by a moderately impressed, weakly undulating suture, sculpture of narrow orthocline to weakly prosocline ribs, 18-20 on penultimate whorl, slightly narrower than their interspaces, narrow spiral grooves present in axial interspaces, 9-10 on penultimate whorl. The last whorl is moderately convex, the ribs weakening gradually towards base, which is imperforate and bears about three spiral grooves. The aperture is ovate-pyriform, columella oblique, and without fold.
The fossil specimen from Estepona is closely similar to the type from Senegal, West Africa. It is smaller (3.0 mm vs 5.9 mm) although at five whorls the fossil shell is not fully grown. The protoconch diameter is similar to that recorded for the type (dp = 310 μm; Peñas *et al*., 2014; p. 200). The very fine reticulated microsculpture illustrated by Peñas *et al*. (2014; fig. 31G) is not preserved in the fossil shell. This species was compared at length with its extant West African congeners by Peñas *et al*. (2014). In the Estepona assemblage it differs from *P. inaequabilis* (Peñas & Rolán, 1997) in having a larger (at fully adult size) shell, the protoconch is type A1 as opposed to type B in *P. inaequabilis*, the suture is shallower, narrower ribs, and there are only three spirals over the base as opposed to 7-8 in *P. inaequabilis*.
Pyrgiscus pablopenasi differs from *P. joubini* (Dautzenberg, 1912) in having a smaller protoconch with the nucleus suture fully visible, whorls flat in the central part, ribs narrower and more numerous, and only three spirals over the base as opposed to 7-8 in *P. joubini*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Senegal (Peñas *et al*., 2014).

***Pyrgiscus rufescens* (Forbes, 1846)**
Plate 115, figs 1-3

*1846 *Chemnitzia rufescens* Forbes, p. 66.
1920 *Turbonilla* (*Pyrgostelis*) *rufescens* (Forbes) – Harmer, p. 570, pl. 49, fig. 29.
1981 *Turbonilla rufescens* (Forbes) – Van Aartsen, p. 67, pl. 1, fig. 8.

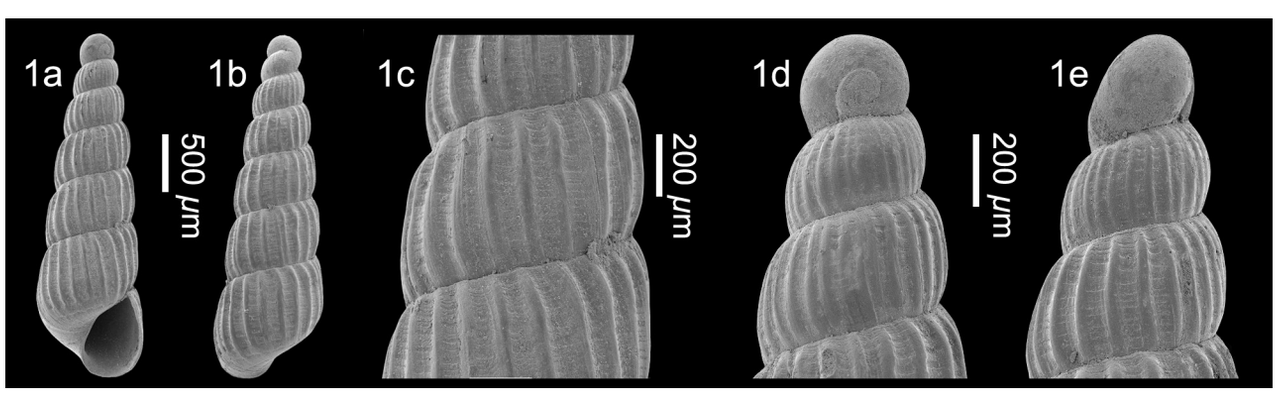

Plate 114. *Pyrgiscus pablopenasi* (Peñas, Rolán & Swinnen, 2014); 1. NHMW 2019/0167/0507, height 3.0 mm, width 905 μm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

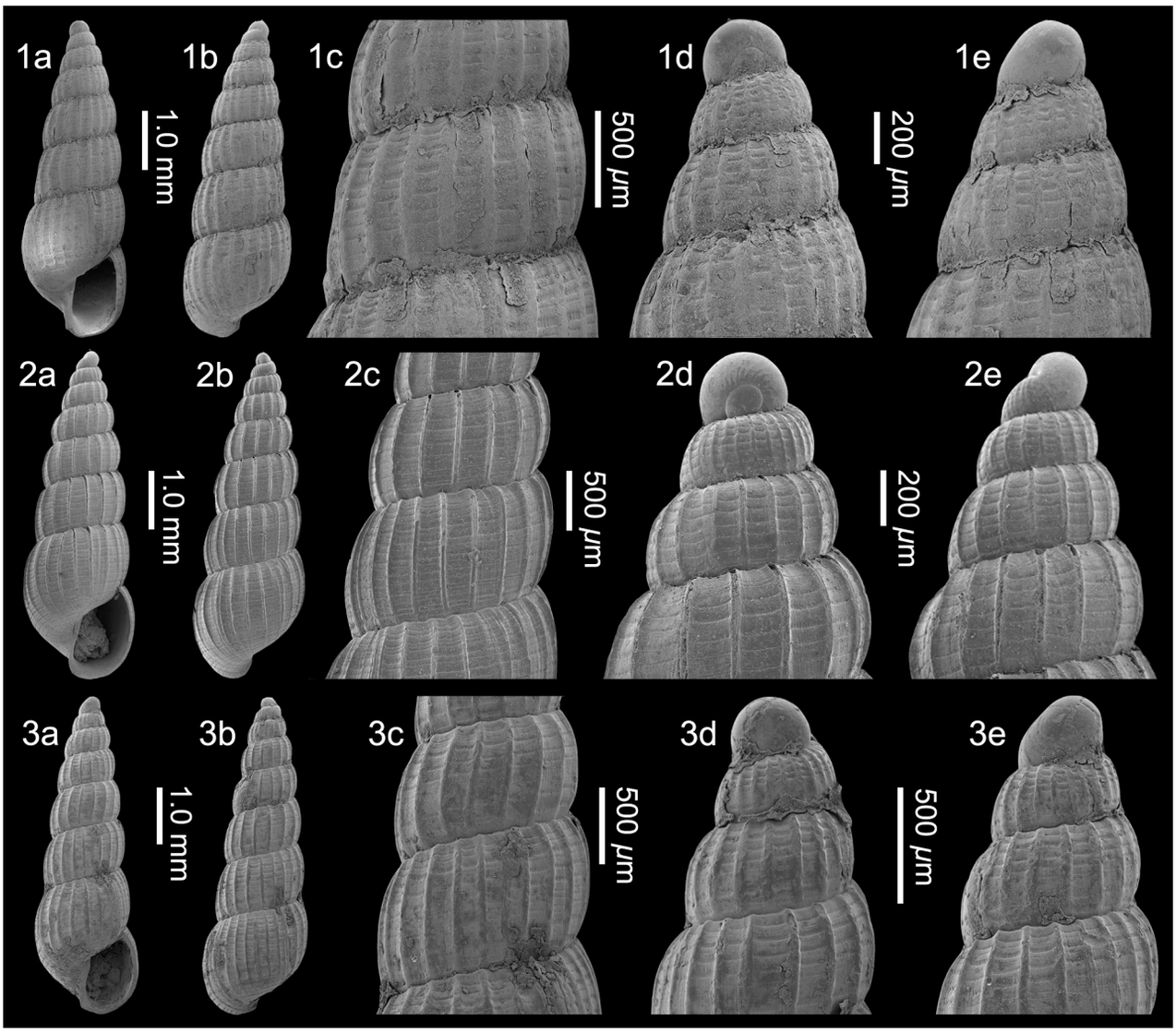

Plate 115. *Pyrgiscus rufescens* (Forbes, 1846); 1. NHMW 2019/0167/0509, height 5.5 mm, width 1.8 mm, 1c, detail of penultimate teleoconch whorl sculpture, 1d-e, detail of of protoconch. Velerín carretera. 2. NHMW 2019/0167/0508, height 5.8 mm, width 1.9 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of of protoconch; 3. NHMW 2019/0167/0526, height 5.6 mm, width 1.8 mm, 3c, detail of sculpture last two spire whorls, 3d-e, detail of protoconch (SEM images). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

1986 *Turbonilla rufescens* (Forbes, 1846) – Fretter *et al*., p. 642, fig. 450.
1988 *Turbonilla rufescens* (Forbes, 1846) – Graham, p. 634, fig. 276.
1992b *Turbonilla rufescens* (Forbes, 1846) – Crovato & Micali, p. 139, pl. 2, fig. 1.
1997 *Turbonilla rufescens* (Forbes, 1846) – Peñas & Rolán, p. 54, figs 133, 134.
2014 *Pyrgiscus rufescens* (Forbes, 1846) – Høisaeter, p. 68, figs 111-113.
2018 *Pyrgiscus rufescens* (Forbes, 1846) – Brunetti & Cresti, p. 114, fig. 503.

Material and dimensions – Maximum height 8.5 mm, width 1.0 mm. **VC**: NHMW 2019/0167/0508 (1). **VS**: NHMW 2019/0167/0509 (1), NHMW 2019/0167/0510 (4), NHMW 2019/0167/0526 (1). **EL**: NHMW 2019/0167/0724 (8).

Discussion – *Pyrgiscus rufescens* (Forbes, 1846) is characterised by its relatively broad shell for the genus, type A1 tending to B protoconch composed of two whorls, (Estepona specimen; dp = 315-335 μm, hp = 290-315 μm, dn = hp = 85 μm, tilted at about 120° to main shell axis), teleoconch of up to seven convex whorls, separated by a moderately impressed linear suture, sculpture of very fine, straight, orthocline ribs, 19-20 on penultimate whorl, separated by interspaces much wider than the ribs, regular fine spiral sculpture present in the axial interspaces that does not cross the ribs, slightly inflated, regularly convex last whorl, the ribs weakening over the base, imperforate, large aperture for genus, and a straight

to slightly oblique columella, without a fold. There is considerable variability as to the width; the typical form is relatively broad (Pl. 115, fig. 2), with exceptionally slender specimens present (Pl. 115, fig. 3), as well as intermediate specimens (Pl. 115, fig. 1).
This species is superficially similar to *Pyrgisculus jeffreysii* (Jeffreys, 1848), but differs in not having shouldered whorls, narrower ribs, and the base is more rounded. *Pyrgiscus scissus* (Chirli & Micali, 2011), with which it co-occurs in the Estepona deposits (see below) is even broader and has more evenly and strongly cancellate sculpture.

Distribution – Lower Pliocene: North Sea Basin, England, Coralline Crag (Harmer, 1920); central Mediterranean, Italy (Crovato & Micali, 1992b; Brunetti & Cresti, 2018). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0294); western Mediterranean, Estepona Basin, S. Spain (this paper). Upper Pleistocene: North Sea Basin, England (Harmer, 1920). Present-day: Atlantic, Norway (Høisaeter, 2014), British Isles (Fretter *et al*., 1986; Graham, 1988), southwards to Ghana and Angola (Peñas & Rolán, 1997).

***Pyrgiscus rufus* (Philippi, 1836)**
Plate 116, fig. 1

*1836 *Melania rufa* Philippi, p. 156, pl. 9, fig. 7.
1844 *Chemnitzia densecostata* Philippi, p. 132, pl. 24, fig. 9.
1848 *Odostomia formosa* Jeffreys, p. 347, pl. 26, fig. 10.
1848 *Chemnitzia densecostata* Phil. – Wood, p. 82, pl. 10, fig. 8.
1882 *Turbonilla* (*Chemnitzia*) *densecostata* Philippi – Bucquoy *et al*., p. 183, pl. 21, fig. 11.
1882 *Turbonilla* (*Melania*) *rufa* Philippi – Bucquoy *et al*., p. 183, pl. 20, fig. 15.
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *praecedens* Sacco, p. 3 [pl. 2, fig. 117; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *dertodecussata* Sacco, p. 4 [pl. 2, fig. 119; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *miopersulcata* Sacco, p. 3 [pl. 2, fig. 120; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *decussata* (Bon.) – Sacco, p. 4 [pl. 2, fig. 122; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *paucidecussata* Sacco, p. 5 [pl. 2, fig. 123; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *multidecussata* Sacco, p. 5 [pl. 2, fig. 124; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *Bellardii* (Segu.) – Sacco, p. 5 [pl. 2, fig. 125; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *percostatoastensis* Sacco, p. 5 [pl. 2, fig. 126; 1892a].
1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *ligustica* Sacco, p. 6 [pl. 2, fig. 128; 1892a].
1914 *Turbonilla* (*Pyrgostelis*) *rufa* Phil. – Cerulli-Irelli, p. 271 [445], pl. 23 [55], figs 44-50.
1920 *Turbonilla* (*Pyrgostelis*) *densecostata* (Philippi) – Harmer, p. 566, pl. 49, figs 24, 25.
1920 *Turbonilla* (*Pyrgostelis*) *formosa* (Jeffreys) – Harmer, p. 569, pl. 49, fig. 30.
1955 *Turbonilla* (*Turbonilla*) *densecostata* (Philippi) – Moroni, p. 102, pl. 5, fig. 26.
1969 *Turbonilla* (*Pyrgostelis*) *rufa* (Philippi) – Fekih, p. 36, pl. 6, fig. 6.
1972b *Turbonilla* (*Pyrgiscus*) *rufa* (Philippi, 1836) – Nordsieck, p. 129, pl. PVI, fig. 7.
1974 *Turbonilla* (*Pyrgiscus*) *densecostata* (Philippi, 1844) – Malatesta, p. 440, pl. 32, fig. 18.
1974 *Turbonilla* (*Pyrgiscus*) *rufa* (Philippi, 1836) – Malatesta, p. 441, pl. 32, fig. 13.
1976 *Turbonilla* (*Pyrgiscus*) *densecostata* (Philippi) – Pavia, p. 114, pl. 11, fig. 15.
1976 *Turbonilla* (*Pyrgiscus*) *rufa* (Philippi) – Pavia, p. 114, pl. 11, figs 28-30.
1976 *Turbonilla* (*Pyrgiscus*) *rufa* (Philippi) – Marasti & Raffi, p. 196, pl. 2, fig. 10.
1982 *Turbonilla* (*Pyrgiscus*) *rufa* (Philippi, 1836) – Martinell, p. 225, pl. 1, fig. 9.
1985 *Turbonilla pusilla* (Philippi) – Martinell & Domènech, p. 32, 34, 38, 40, pl. 3, fig. 3 [*non Chemnitzia pusilla* (Philippi, 1844)].
1987 *Turbonilla* (*Pyrgiscus*) *densecostata* (Philippi, 1844) – Cuerda Barceló, p. 329, pl. 30, fig. 14.
1992 *Turbonilla rufa* (Philippi, 1836) – Cavallo & Repetto, p. 164, fig. 468.
1996 *Turbonilla rufa* (Philippi, 1836) – Peñas *et al*., p. 72, figs 161, 162.
1997 *Turbonilla rufa* (Philippi, 1836) – Peñas & Rolán (*partim*), p. 68, [*non* figs 194-198 = *Pyrgiscus crenatus* (Brown, 1827)].
2001 *Turbonilla rufa* (Philippi, 1836) – Silva, p. 572, pl. 27, figs 1, 2.
2001 *Turbonilla rufa* (Philippi, 1836) – Cachia *et al*., p. 115, pl. 19, fig. 2.
2004 *Turbonilla rufa* (Philippi, 1836) – Solustri & Micali, p. 68, fig. 5n.
2009 *Turbonilla rufa* (Philippi, 1836) – Peñas *et al*., p. 34, figs 29-32.
2009 *Turbonilla rufa* (Philippi, 1836) – de Frias Martins *et al*., p. 66, fig. 269.
2011 *Turbonilla rufa* (Philippi, 1836) – Landau *et al*., p. 41, pl. 22, fig. 18.
2011 *Turbonilla rufa* (Philippi, 1836) – Chirli & Micali, p. 98, pl. 35, figs 13-18, pl. 36, 1-18.
2011 *Turbonilla rufa* (Philippi, 1836) – Chirli & Linse, p. 208, pl. 82, fig. 3.
2013 *Turbonilla rufa* (Philippi, 1836) – Öztürk & Bitlis Bakir, p. 432, fig 24A-D.
2014 *Pyrgiscus rufus* (Philippi, 1836) – Giannuzzi-Savelli *et al*., p. 84, figs 278, 279, 281-284, appendix p. 33, 81.
2014 *Pyrgiscus rufus* (Philippi, 1836) – Høisæter, p. 65, fig. 108.
2018 *Pyrgiscus rufus* (Philippi, 1836) – Ceulemans *et al*., p. 136, pl. 8, figs 12-14.
2018 *Pyrgiscus rufus* (Philippi, 1836) – Brunetti & Cresti, p. 114, fig. 504.
2018 *Turbonilla rufa* (Philippi, 1836) – Trigo *et al*., p.

363, fig. 46.

2020 *Pyrgiscus rufus* (Philippi, 1836) – Landau *et al*., p. 333, pl. 63, figs 1-2.

non 1892a *Turbonilla* (*Strioturbonilla*) *densecostata* var. *plioastensis* Sacco, p. 678, pl. 2, fig. 115.

non 1892a *Turbonilla* (*Strioturbonilla*) *densecostata* var. *subalpina* Sacco, p. 96, pl. 2, fig. 116 [= *Pyrgiscus subalpinus* (Sacco, 1892)].

non 1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *exdensecostata* Sacco, p. 4 [pl. 2, fig. 118; 1892a] [= *Pyrgiscus exdensecostatus* (Sacco, 1892)].

non 1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *amplisuturata* Sacco, p. 4 [pl. 2, fig. 121; 1892a] [= *Pyrgiscus amplisuturatus* (Sacco, 1892)].

non 1892b *Turbonilla* (*Pyrgostelis*) *rufa* var. *giganteoastensis* Sacco, p. 6 [pl. 2, fig. 127; 1892a] [= *Pyrgiscus giganteoastensis* (Sacco, 1892)].

non 1958 *Turbonilla rufa* (Philippi) – Sorgenfrei, p. 328, pl. 72, fig. 244a-c.

non 1984 *Turbonilla* (*Strioturbonilla*) *densecostata* (Philippi) – A.W. Janssen, p. 360, pl. 17, fig. 2 [= *Pyrgiscus borealis* (Kautsky, 1925)].

non 1984 *Turbonilla* (*Strioturbonilla*) *densecostata* var. *subalpina* Sacco, 1892 – Ferrero Mortara *et al*., p. 84, pl. 13, fig. 7 [= *Pyrgiscus subalpinus* (Sacco, 1892)].

non 1997 *Turbonilla rufa* (Philippi) – Ruiz Muñoz *et al*., p. 188, pl. 41, fig. 2 [=*Pyrgulina stefanisi* (Jeffreys, 1869)].

Material and dimensions – Maximum height 8.5 mm, width 1.0 mm. **CO**: NHMW 2019/0167/0409 (9). **VC**: NHMW 2019/0167/0095 (1), NHMW 2019/0167/0096 (50+). **VS**: NHMW 2019/0167/0856 (1). **EL**: NHMW 2019/0167/0114 (26).

Discussion – Two similar species occur in the European extant fauna; *Pyrgiscus rufus* (Philippi, 1836) and *P. crenatus* (Brown, 1827), which have sometimes been synonymised (*i.e*. van Aartsen, 1981, p. 75). Peñas *et al*. (2009, p. 34) argued for the separation of the two taxa: in the Mediterranean *P. rufus* with a smaller protoconch (255-260 μm) and a narrow shell and in the Atlantic *P. crenatus* with a larger protoconch (300-310 μm) and a broader shell. Subsequently Peñas & Rolán (2011, p. 396) stated that it is not possible to exclude that *P. rufus* was an extreme morphotype of *P. crenatus*. Høisæter (2014) considered them separate species.

It is possible that such a distinction did not exist in the Pliocene, as many of the Italian Pliocene shells illustrated by Chirli & Micali (2011, pl. 35, fig. 13) are quite broad and the shells illustrated by Ceulemans *et al*. (2018, pl. 8, figs 12-14) from the lower Pliocene Atlantic of northwestern France are of the narrow *rufus* form rather than the *crenatus* form, as would be expected in the Atlantic. The Estepona specimens are narrow, as would be expected, but the protoconch is even larger (Estepona specimen; dp = 355 μm, hp = 325 μm, dn = 75 μm, tilted at about 120° to main shell axis) than the measurement given by Peñas *et al*. (2009) for *P. crenatus*.

The lower Pleistocene North Sea Basin record given by Van Regteren Altena *et al.* (1964, pl. 21, fig. 202) as *T.* (*Pyrgiscus*) *crenata* has the characters typical of the broader Atlantic *P. crenatus*. The matter may be solved only with a detailed study of present-day specimens and soft parts.

Distribution – Upper Miocene: Atlantic (Tortonian), NW France (Landau *et al*., 2020), southern Spain (Cárdenas *et al*., 2019). Proto-Mediterranean (Tortonian and Messinian), Italy (Sacco, 1892b; Moroni, 1955). Lower Pliocene: North Sea Basin, Coralline Crag, England (S.V. Wood, 1848; Harmer, 1920); Atlantic, NW France (Ceulemans *et al*., 2018), Guadalquivir Basin, Spain (Landau *et al*., 2011); western Mediterranean, northeastern Spain, (Martinell, 1982; Martinell & Domènech, 1985), Tunisia (Fekih, 1969); central Mediterranean, Italy (Sacco, 1892b; Pavia, 1976; Crovato & Micali, 1992b; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001; NHMW 2018/0331/0340); western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Sacco, 1892b; Malatesta, 1974; Marasti & Raffi, 1976; Cavallo & Repetto, 1992; Ferrero *et al*., 2005); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Lower

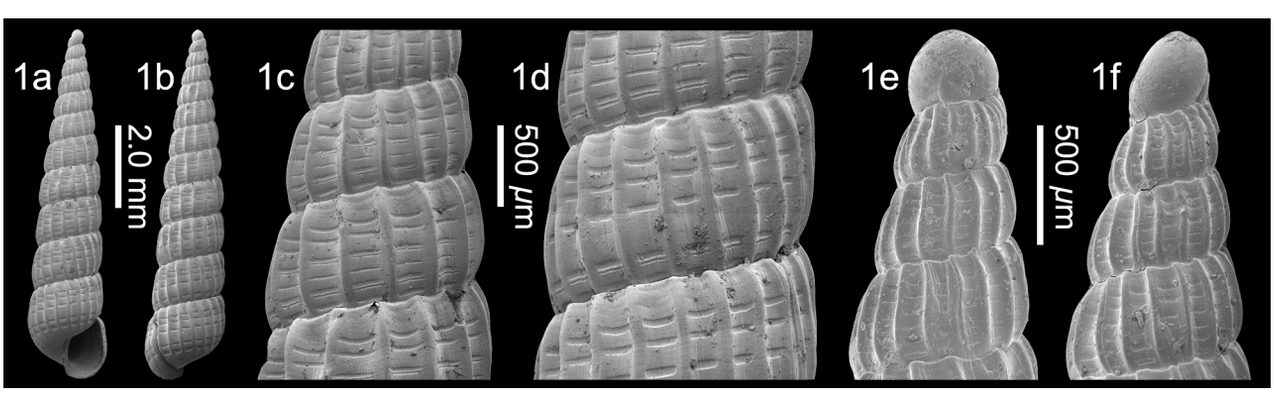

Plate 116. *Pyrgiscus rufus* (Philippi, 1836); 1. NHMW 2019/0167/0095, height 8.5 mm, width 1.0 mm, 1c, detail of early teleoconch sculpture, 1d, detail of teleoconch sculpture penultimate whorl, 1e-f, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Pleistocene: Atlantic, St. Erth, England (Harmer, 1920); central Mediterranean, Italy (Cerulli-Irelli, 1914; Gianolla *et al*., 2010; Brunetti, 2011); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: English Channel, England (Harmer, 1920); western Mediterranean, Balearic Islands (Bucquoy *et al*., 1882; Cuerda Barceló, 1987; Peñas *et al*., 1996). Present-day: Possibly restricted to Mediterranean: western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Solustri & Micali, 2004; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk & Bitlis Bakir, 2013), Atlantic forms may all represent *P. crenatus* (Nordsieck, 1972b; Peñas *et al*., 2009), northwestern France (Trigo *et al*., 2018), Azores (de Frias Martins *et al*., 2009), Madeira and Selvagens Islands (Segers *et al*., 2009).

***Pyrgiscus scissus* (Chirli & Micali, 2011)**
Plate 117, fig. 1

*2011 *Turbonilla scissa* Chirli & Micali, p. 102, pl. 37, figs 1-6.

Material and dimensions – Height 5.7 mm, width 2.2 mm. **VS**: NHMW 2019/0167/0438 (1).

Discussion – *Pyrgiscus scissus* (Chirli & Micali, 2011) is a distinctive species, with its broad shell for the genus, type B protoconch, up to seven moderately convex whorls, with the periphery just above the suture, separated by a weakly impressed linear suture, and finely cancellate sculpture composed of narrow orthocline ribs, overrun by even finer cords, bifid at the periphery on later whorls. The last whorl is relatively inflated, convex at the periphery, the ribs weakening at the periphery, base covered in fine close-set cords, the aperture is large, the columella vertical, with a very weak fold. *Pyrgiscus scissus* is no particularly similar to any other species. *Pyrgiscus engli* (Peñas & Rolán, 1997) from present-day Angola is similar in having a broad shell, but differs in having a very superficial suture and even finer-meshed cancellate sculpture.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Pyrgiscus* sp. 1**
Plate 118, figs 1-2

Material and dimensions – Maximum height 3.0 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0665-0666 (2), NHMW 2019/0167/0667 (2).

Discussion – This species has a moderately broad shell for the genus, type B protoconch (dp = 295 μm, tilted at 120° to main shell axis), five moderately convex teleoconch whorls, with the periphery just above the suture, separated by a moderately impressed finely undulating suture. The sculpture consists of narrow, slightly prosocline ribs, about 32 on penultimate whorl, slightly narrow than their interspaces, with about 12 irregular grooves in the axial interspaces. The last whorl is slightly inflated, with the ribs not persisting over the base, which bears narrow grooves, the aperture is large, the columella vertical, with a very weak fold. The specimen does not seem to be conspecific with any known *Pyrgiscus* species, but we hesitate to describe it as new due to lack of uniquely characterising features. It differs from *Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946) in having a stouter outline, less convex whorls, and less deep suture. From *P. amplisuturatus* (Sacco, 1892) it differs in its stouter outline, stronger axial ribs, less convex whorls, and more superficial suture.

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

***Pyrgiscus* sp. 2**
Plate 119, fig. 1

Material and dimensions – Maximum height 3.0 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0668 (1), NHMW 2019/0167/0669 (1).

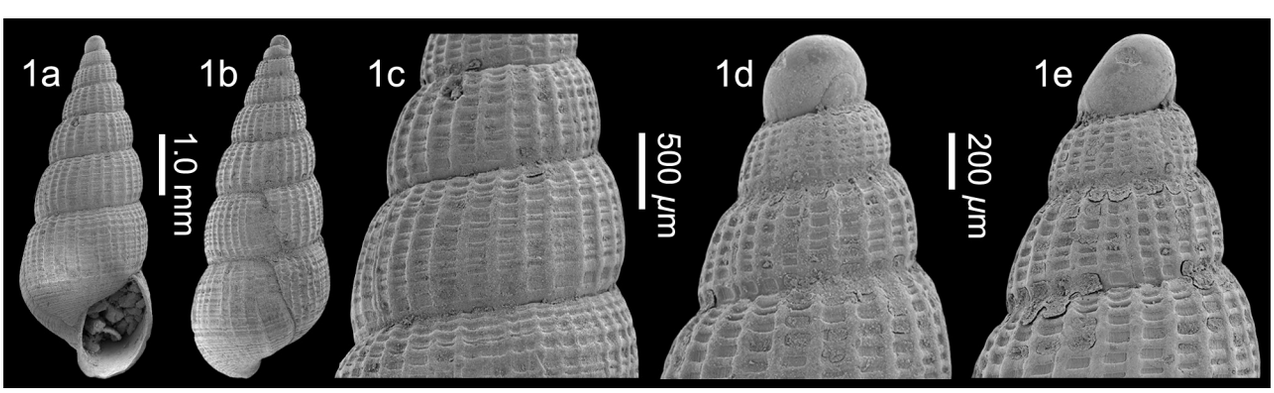

Plate 117. *Pyrgiscus scissus* (Chirli & Micali, 2011); 1. NHMW 2019/0167/0438, height 5.7 mm, width 2.2 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

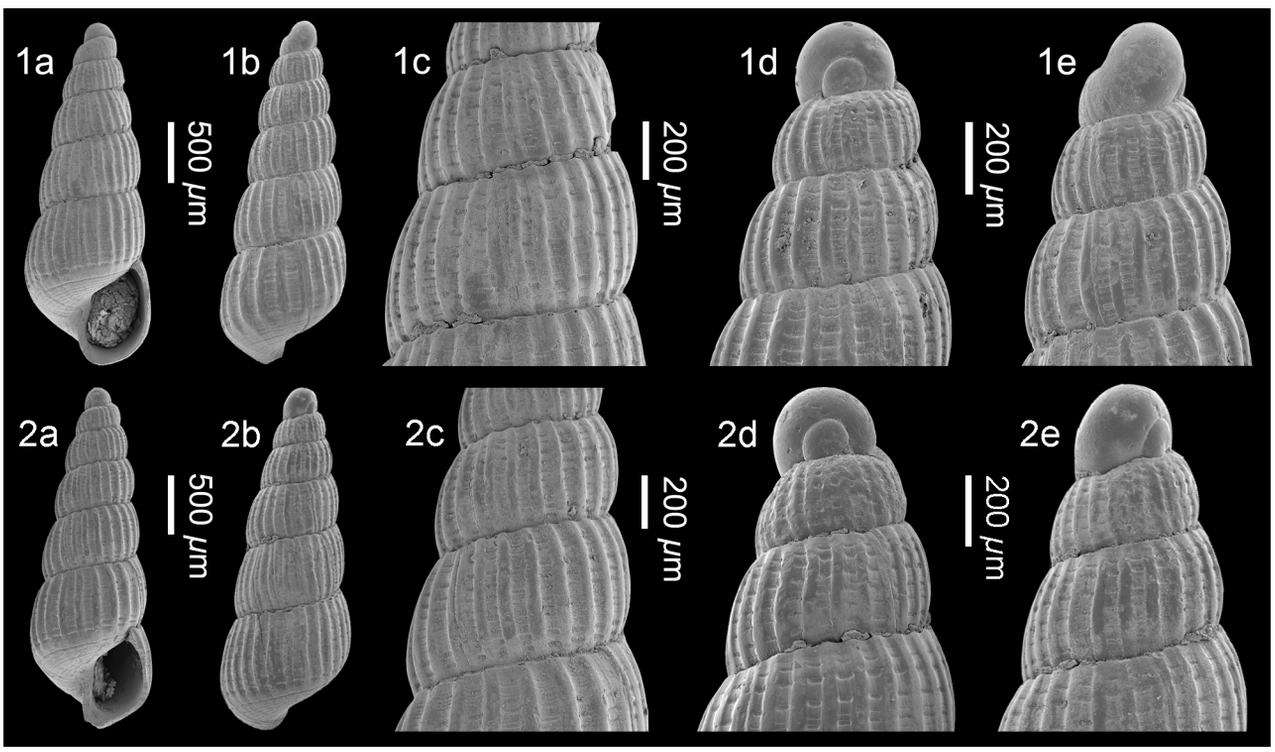

Plate 118. *Pyrgiscus* sp. 1; 1. NHMW 2019/0167/0665, height 2.8 mm, width 1.1 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch. 2. NHMW 2019/0167/0666, height 3.0 mm, width 1.1 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

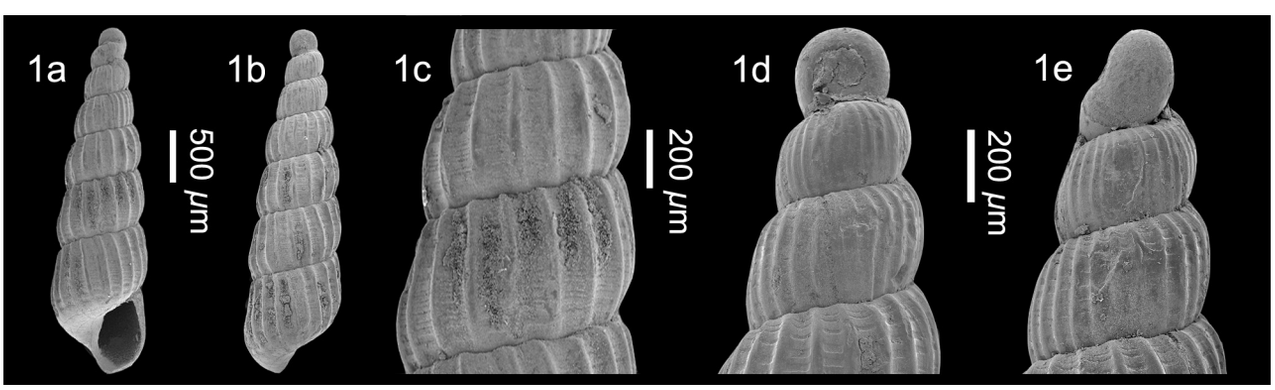

Plate 119. *Pyrgiscus* sp. 2; 1. NHMW 2019/0167/0668, height 3.4 mm, width 955 µm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Description – Shell small, slender conical. Protoconch type A1, planispiral (dp = 260 µm, hp = 170 µm, tilted at angle of 110° to main shell axis; partly obscured by matrix). Teleoconch of six whorls, initially convex, third whorl flat-sided later slightly pinched adapical half, slightly swollen in abapical half, forming whorl periphery below mid-whorl. Suture deeply impressed, weakly undulating. Sculpture of narrow, prosocline ribs, 17 on penultimate whorl, roughly one-third width of their interspaces, about ten subequal spiral grooves in axial interspaces. Last whorl 40% height, weakly pinched adapically, slightly swollen and rounded at periphery, ribs weakening over base. Aperture ovate, columella slightly oblique and thickened, without fold.

Discussion – This species is similar in profile to *Pyrgiscus gabrielae* Peñas, Rolán & Swinnen, 2014 from West Africa, but the protoconch of that species is almost double the size (260 µm; Peñas *et al*., 2014, p. 198). '*Turbonilla*' sp. 2 in Peñas *et al*. (2014, p. 202, figs 32E-G), which we consider represents a *Pyrgiscus* species, is also comparable, has similar protoconch dimensions and sculpture, but differs in whorl profile.

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

Genus *Pyrgolidium* Monterosato, 1884

Type species – *Chemnitzia internodula* Wood, 1848, by original designation, Pliocene, British Isles.

1884 *Pyrgolidium* Monterosato, p. 89.

Note – Species in this genus are characterised by their solid shell and broad rounded ribs crossed by a single cord placed about mid-whorl that distorts or constricts the ribs. In the European Miocene to present-day faunas it is represented by a single species *P. internodulum* (Wood, 1848) (*Odostomia rosea* Monterosato, 1877 is a synonym).

***Pyrgolidium internodulum* (Wood, 1848)**
Plate 120, fig. 1

*1848 *Chemnitzia internodula* Wood, p. 81, pl. 10 fig. 6.
1877 *Odostomia rosea* Monterosato, p. 38, pl. 3, fig. 1.
1878 *Turbonilla internodula* S. Wood – Nyst, pl. 6, fig. 3.
1882 *Turbonilla internodula* S. Wood – Nyst, p. 73.
1879 *Chemnitzia internodula* var. *ligata* Wood, p. 24, pl. 2, fig. 11.
1892a *Turbonilla* (*Pyrgolidium*) *internodula* (Wood) – Sacco, p. 84.
1892a *Turbonilla* (*Pyrgolidium*) *internodula* var. *miocenica* Sacco, p. 84, pl. 2, fig. 82.
1892a *Turbonilla* (*Pyrgolidium*) *internodula* var. *turrituloides* Sacco, p. 84, pl. 2, fig. 83.
1892a *Turbonilla* (*Pyrgolidium*) *internodula* var. *subanodulina* Sacco, p. 84, pl. 2, fig. 84.
1892a *Turbonilla* (*Pyrgolidium*) *internodula* var. *astensipupoidea* Sacco, p. 84, pl. 2, fig. 84*bis*.
1914 *Turbonilla* (*Pyrgolidium*) *internodula* (S. Wood) – Cerulli-Irelli, p. 277 [451], pl. 23 [55], figs 68, 69.
1920 *Turbonilla* (*Pyrgolidium*) *internodula* (S.V. Wood) – Harmer, p. 572, pl. 49, figs 33, 34.
1920 *Turbonilla* (*Pyrgolidium*) *internodula* var. *ligata* (J. Reeve [sic]) – Harmer, p. 573, pl. 49, fig. 35.
1920 *Turbonilla* (*Pyrgolidium*) *internodula* var. *acuminata* Harmer, p. 574, pl. 49, fig. 36.
1920 *Turbonilla* (*Pyrgolidium*) *internodula* var. *conica* Harmer, p. 574, pl. 49, figs 37, 38.
1920 *Turbonilla* (*Pyrgolidium*) *rosea* (Monterosato) – Harmer, p. 574, pl. 49, fig. 39.
1949a *Turbonilla* (*Pyrgolidium*) *internodula miocaenica* Sacco, 1892 – Glibert, p. 190, pl. 12, fig. 7.
1958 *Turbonilla* (*Pyrgolidium*) *internodula* f. *internodula* Wood – Glibert, p. 19, pl. 2, fig. 14a, b.
1958 *Turbonilla* (*Pyrgolidium*) *internodula* f. *acuminata* Harmer, 1920 – Glibert, p. 20, pl. 2, fig. 14c.
1958 *Turbonilla* (*Pyrgolidium*) *internodula* f. *harmeri* Glibert, p. 20, pl. 2, fig. 14d.
1964 *Turbonilla* (*Pyrgolidium*) *internodula* var. *miocaenica* Sacco, 1892 – Brébion, p. 294, pl. 7, fig. 18.
1964 *Turbonilla* (*Pyrgolidium*) *internodula* S.V. Wood – Van Regteren Altena *et al.*, p. 5, pl. 21, fig. 201.
1969 *Turbonilla* (*Pyrgolidium*) *internodula* (Wood.) – Fekih, p. 34, pl. 6, fig. 2.
1972b *Turbonilla* (*Pyrgolidium*) *rosea* (Monterosato, 1877) – Nordsieck, p. 130, pl. PVI, fig. 11.
1996 *Turbonilla internodula* (Woods [*sic*] S., 1848) – Peñas *et al*., p. 62, figs 151.
1997 *Turbonilla* (*Pyrgolidium*) *internodula* (Wood, 1848) – Marquet, p. 109, pl. 10, fig. 4.
1997 *Turbonilla internodula* (S. Wood, 1848) – Peñas & Rolán, p. 46, figs 103-105.
1998 *Turbonilla* (*Pyrgolidium*) *internodula* (Wood, 1848) – Marquet, p. 202, fig. 174.
2001 *Turbonilla internodula* (Wood, 1848) – Silva, p. 571, pl. 26, figs 22, 23.
2005 *Turbonilla internodula* (S. Wood, 1848) – Rolán, p. 197, fig. 903.
2011 *Turbonilla internodula* (Wood S, 1848) – Chirli & Micali, p. 81, pl. 29, figs 7-12 (*cum syn*.).
2011 *Turbonilla florentina* (Costa, O.G., 1861) – Chirli & Linse, p. 205, pl. 80, fig. 3 [*non Chemnitzia florentina* (Costa, 1861)].
2011 *Turbonilla internodula* (S. Wood, 1848) – Hernández *et al*., p. 266, fig. 84K.
2011 *Turbonilla internodula* (Wood S, 1848) – Chirli & Linse, p. 206, pl. 81, fig. 1.
2014 *Pyrgolidium internodulum* (S. Wood, 1848) – Giannuzzi-Savelli *et al*., p. 86, fig. 287, appendix p. 33, 81.
2020 *Pyrgolidium internodulum* (S. Wood, 1848) – Landau *et al*., p. 334, pl. 64, figs 1-3.

Material and dimensions – Maximum height 9.2 mm, width 2.3 mm. **VC**: NHMW 2019/0167/0705 (2). **CO**: NHMW 2019/0167/0113 (14), NHMW 2019/0167/0546 (5). **EL**: NHMW 2019/0167/0112 (30).

Discussion – *Pyrgolidium internodulum* is a very distinctive species, characterised by its solid shell and broad rounded ribs crossed by a single cord placed about mid-whorl that distorts or constricts the ribs. The protoconch of type B of 2.25 whorls, with the nucleus almost completely exposed (Estepona specimen; dp = 345 μm, hp = 270 μm, tilted at about 130° to main shell axis). This is somewhat larger than the protoconch dimensions given by Peñas & Rolán (dp = 290 μm; 1997, p. 46) for an extant specimen from the Cape Verde Islands, and the specimen figured by Landau *et al*. (dp = 300 μm; 2020, pl. 64, fig. 3c). All these protoconch measurements agree with further samples from the Italian Pliocene (dp = 325-350 μm) and present-day specimens from SW Spain (300-320 μm; PM, personal data). The ribs on the last whorl end relatively abruptly at the periphery, but without forming a basal disc. The base is smooth and imperforate.
As discussed by Landau *et al*. (2020, p. 335), we consider unjustified the separation of the Pliocene-extant *Pyrgolidium internodulum* (Wood, 1848) from the Miocene chronosubspecies *Turbonilla* (*Pyrgolidium*) *internodula miocaenica* Sacco, 1892 as suggested by Glibert (1949a, p. 190).
Pyrgolidium internodulum (Wood, 1848) had a wider geographic distribution in the fossil record than it has to-

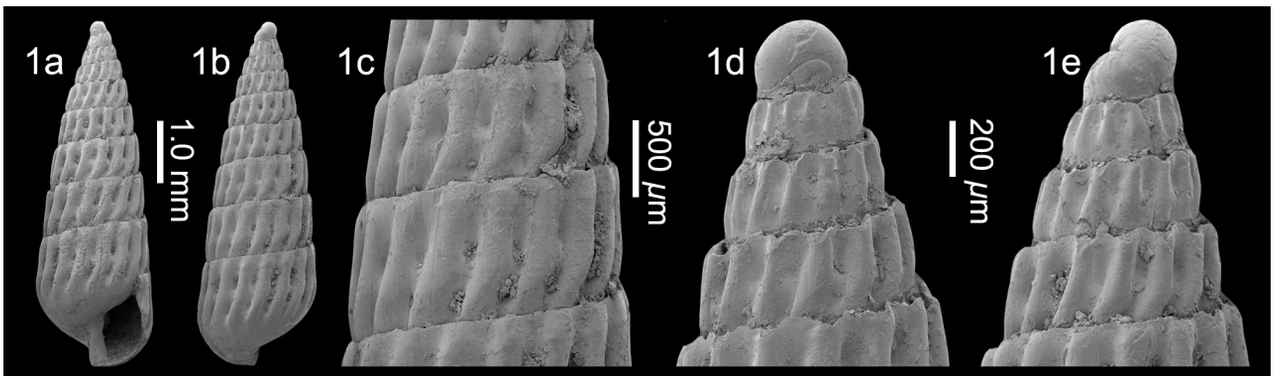

Plate 120. *Pyrgolidium internodulum* (Wood, 1848); 1. NHMW 2019/0167/0546, height 5.8 mm, width 1.9 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

day, where it does not occur north of southern Portugal. This range contraction seems to have occurred relatively recently, possibly during the last Würm glaciation, as it was still present around the British Isles in upper Pleistocene deposits (Harmer, 1920). For discussion further see Landau *et al.* (2020, p. 335).

Distribution – Middle Miocene: Atlantic (Langhian), Loire Basin, France (Glibert, 1949a). Upper Miocene: Atlantic (Tortonian and Messinian): NW France (Brébion, 1964; Landau *et al*., 2020); Proto-Mediterranean Sea: Po Basin, Italy (Sacco, 1892a). Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1848; Harmer, 1920), Kattendijk Formation, Belgium (Marquet, 1997, 1998); Atlantic, NW France (Brébion, 1964); central Mediterranean, Italy (Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, Red Crag, England (Wood, 1848; Harmer, 1920), Oorderen and Kruisschans Sands, Belgium (Marquet, 1997, 1998); Atlantic, Mondego Basin, Portugal (Silva, 2001; NHMW 2018/0331/0291); western Mediterranean, Estepona Basin, Spain (Peñas & Rolán, 1997); central Mediterranean, Italy (Sacco, 1892a). Upper Pliocene-Pleistocene: Atlantic, NW France (Brébion, 1964). Lower Pleistocene: North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964); central Mediterranean, Italy (Cerulli-Irelli, 1914); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: North Sea Basin, British Isles (Harmer, 1920). Present-day: Atlantic, southern Portugal, West Africa, Morocco, Canary Islands (Hernández *et al*., 2011), Senegal south to Angola (Rolán, 2005), Mediterranean, mainly limited to the South West of Spain, adjacent to the Strait of Gibraltar (Peñas *et al*., 1996) with occasional records in Sicily and Tyrrhenian Italian coasts (Peñas & Rolán, 2011; Giannuzzi-Savelli *et al*., 2014).

Genus *Pyrgostylus* Monterosato, 1884

Type species – Turbo striatulus Linnaeus, 1758, by monotypy, present-day, Mediterranean.

1884 *Pyrgostylus* Monterosato, p. 90.

Note – Turbonillids here included in the genus *Pyrgostylus* Monterosato, 1884 are similar to *Mormula* A. Adams, 1863 in having axial ribs, deeply incised spiral grooves, and irregular broad varices on the later teleoconch whorls. This genus has been synonymised by some authors (i.e. Glibert, 1949a), however, in *Mormula* the axials weaken gradually on the last whorl, whereas in *Pyrgostylus* they end abruptly at a well developed basal disc and the base bears only spiral sculpture. Moreover, the shell is slenderer and less solid than *Mormula*.

***Pyrgostylus abreui* (Peñas & Rolán, 2000)**
Plate 121, figs 1-2

*2000 *Turbonilla abreui* Peñas & Rolán, p. 70, figs 40-45.
2000 *Turbonilla abreui* Peñas & Rolán, 2000 – Peñas *et al*., p. 186, figs 27A-B.

Material and dimensions – Maximum height 6.6 mm, width 2.0 mm. **EL**: NHMW 2019/0167/0820-0821 (2), NHMW 2019/0167/0822 (2).

Discussion – Pyrgostylus abreui (Peñas & Rolán, 2000) is characterised by its very solid slender conical shell, with an elevated type A1 protoconch (Estepona specimen; dp = 265 μm, hp = 235 μm, tilted at angle of about 118° to main shell axis: extant specimens 244 μm, *fide* Peñas & Rolán, 200, p. 70). The teleoconch consists of seven rather barrel-shaped whorls separated by a shallow, narrowly impressed, undulating suture. Sculpture is absent on the first teleoconch whorl, from second whorl raised, stout, orthocline to weakly opisthocline ribs, sometimes sinuous just below the suture, 12-15 on last whorl, narrower than their interspaces. On the spire whorls there is a suggestion of 2-3 faint irregular cords that overrun the ribs, making them indistinctly nodular. The last whorl has the base very strongly delimited by a raised peribasal cord, the ribs cross the cord, making it nodular and extend a short distance over the base, weakening rapidly towards the aperture. The outer lip is strongly thickened by labial varix, and in-

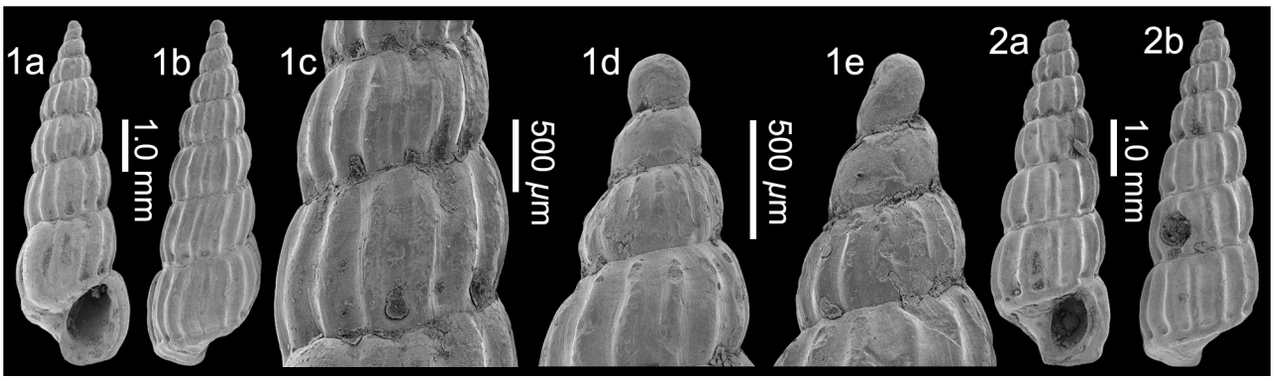

Plate 121. *Pyrgostylus abreui* (Peñas & Rolán, 2000); 1. NHMW 2019/0167/0821, height 6.6 mm, width 2.0 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0822, height 6.0 mm, width 2.1 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

distinctly, but coarsely denticulate within. In one specimen (Pl. 121, fig. 1a) a second strong varix is present at about 120° to the labial varix. The aperture is ovate, the columella concave, without a fold. Peñas & Rolán illustrated a microsculpture of very fine threads (2000, figs, 42, 43) which is not seen in the slightly abraded Estepona specimens.
As rightly pointed out by Peñas & Rolán (2000, p. 70) this species is clearly different from all know species in the study area (Europe, West Africa). However, it is very closely similar to *Pyrgostylus hemiacirseoides* (Sacco, 1892), with which it co-occurs in the Pliocene Estepona assemblages, and shares the very solid shell, strong axial sculpture composed of robust ribs that stop abruptly at a prominent, elevated peribasal cord, very fine spiral microsculpture, a strongly varicose outer lip and a second varix set at 120° intervals in some specimens, and having weak, but coarse denticles within the lip. *Pyrgostylus abreui* differs in being smaller (largest incomplete fragment of *P. hemiacirseoides* 14.7 mm height; see below), in having a greater growth rate resulting in a more conical profile, in having fewer ribs, and in lacking spiral sculpture that completely covers the whorl in *P. hemiacirseoides*. The protoconch of *P. hemiacirseoides* (Pl. 122, figs 1d-e) is much larger (dp = 455 μm, hp = 390 μm vs dp = 265 μm, hp = 235 μm) and more tilted, type A1 tending to B rather than type A1. This is the first fossil record for this species that today is found only on the Atlantic Island of Madeira.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Madeira (Peñas & Rolán, 2000; Segers *et al*., 2009; Peñas *et al*., 2014).

***Pyrgostylus hemiacirseoides* (Sacco, 1892)**
Plate 122, figs 1-4

1892a *Turbonilla* (*Pyrgostylus*) *hemiacirseoides* Sacco, pl. 2, fig. 148.
*1892b *Turbonilla* (*Pyrgostylus*) *hemiacirseoides* Sacco, p. 12.
1969 *Pyrgostylus hemiacirseoides* Sacco – Fekih, p. 45, pl. 8, fig. 5.
1984 *Turbonilla* (*Pyrgostylus*) *hemiacirseoides* Sacco, 1892 – Ferrero Mortara *et al*., p. 87, pl. 13, fig. 4.
2018 *Turbonilla hemiarcisoides* [*sic*] (Sacco, 1892) – Brunetti & Cresti, p. 110, fig. 486.

Material and dimensions – Maximum height 14.7 mm (incomplete), width 4.3 mm. **CO**: NHMW 2019/0167/0183 (1), NHMW 2019/0167/0184 (apertural fragment), NHMW 2019/0167/2010-2012 (2 apertural fragment + 1 spire fragment). **EL**: NHMW 2019/0167/0216 (9 subadult + 2 apertural fragment + 2 spire fragment), NHMW 2019/0167/0825 (1 juvenile).

Discussion – *Pyrgostylus hemiacirseoides* (Sacco, 1892) illustrates clearly all the typical generic characters. The specimens from Estepona illustrated are all incomplete or juvenile, but it is large for a turbonillid, similar to the incomplete holotype which is about 19 mm in height (figured by Ferrero Mortara *et al*., 1985, pl. 13, fig. 4). The only important difference between the Italian and Spanish specimens is in the slightly greater number of axial ribs in the latter (13-16 in the Italian specimens; *fide* Sacco, 1892b, p. 12; vs. 19-28 in the Estepona specimen). However, specimens from the upper Pliocene Piacenzian specimens from Guidonia (Italy) have 17-19 ribs on the last whorl (PM personal observation), suggesting a large variability in the number of ribs between individuals or possibly populations for this species. The most gerontic specimen (Pl. 122, fig. 3) has four low, stout elongated denticles a short distance within the outer lip. The juvenile illustrated here with its protoconch preserved (Pl. 122, fig. 1) shows it to be large, of type A1 tending to B, composed of 2.25 whorls (dp = 455 μm, hp = 390 μm, tilted at angle of about 122° to main shell axis).
Pyrgostylus hemiacirseoides differs from its congeners in the *P. striatulus* (Linnaeus, 1758) species group [*P. lanceae* (Libassi, 1859), *P. striatulolanceae* (Sacco, 1892); see below], in having almost straight-sided whorls as opposed to strongly convex, orthocline instead of strongly opisthocline axial ribs and more strongly devel-

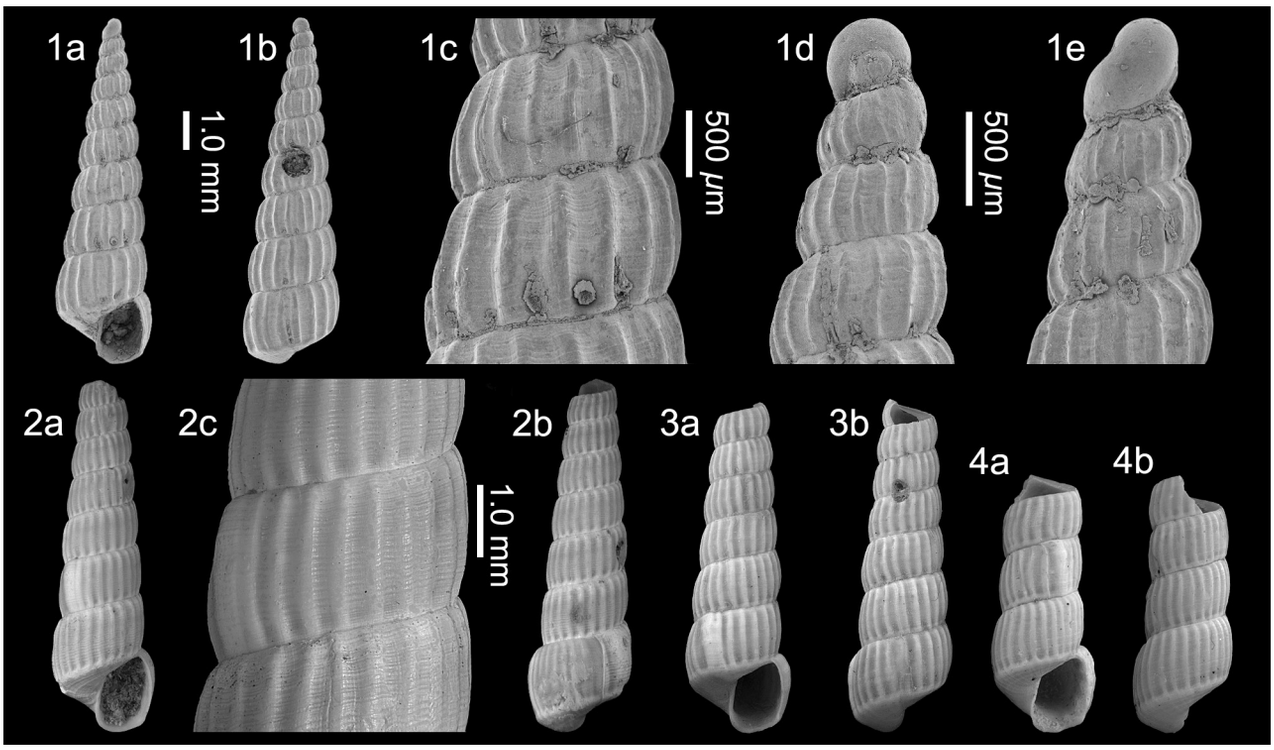

Plate 122. *Pyrgostylus hemiacirseoides* (Sacco, 1892); 1. NHMW 2019/0167/0825, height 8.8 mm, width 2.4 mm (juvenile), 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM images). El Lobillo. 2. NHMW 2019/0167/0183, height 14.7 mm, width 4.3 mm, 2c, detail of teleoconch sculpture penultimate whorl; 3. NHMW 2019/0167/0210, height 13.7 mm, width 4.3 mm; 4. NHMW 2019/0167/0211, height 10.8 mm, width 4.3 mm (digital images). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

oped peribasal cord rather than just a basal disc. This species seems to be exceedingly uncommon in the Pliocene Mediterranean.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018), Tunisia (Fekih, 1975). Upper Pliocene: Atlantic, Mondego Basin, Portugal (this paper; NHMW 2018/0331/0339); western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892b; Ferrero Mortara *et al*., 1984).

Pyrgostylus lanceae **(Libassi, 1859)**

Plate 123, fig. 1

*1859 *Chemnitzia lanceae* Libassi, p. 21, fig. 6.
1892b *Turbonilla* (*Pyrgostylus*) *Lanceae* (Lib.) – Sacco, p. 8.
1892b *Turbonilla* (*Pyrgostylus*) *Lanceae* var. *communis* Sacco, p. 9 [pl. 2, fig. 139; 1892a].
1892b *Turbonilla* (*Pyrgostylus*) *Lanceae* var. *convexa* Sacco, p. 9 [pl. 2, fig. 140; 1892a].
1914 *Turbonilla* (*Pyrgostylus*) *pallida* var. *Lanceae* Lib. – Cerulli-Irelli, p. 275 [449], pl. 23 [55], fig. 61.
1949a *Turbonilla* (*Mormula*) *lanceae convexa* Sacco, 1892 – Glibert, p. 196, pl. 12, fig. 8.
1964 *Turbonilla* (*Mormula*) *lanceae* (Libassi, 1859) – Moroni & Paonita, p.10, fig. 5 (*cum syn*.).
1969 *Pyrgostylus lanceae* Libassi – Fekih, p. 43, pl. 8, fig. 1.
1969 *Pyrgostylus lanceae* var. *communis* Sacco – Fekih, p. 43, pl. 8, fig. 2.
1969 *Pyrgostylus lanceae* var. *convexa* Sacco – Fekih, p. 43, pl. 8, fig. 2.
1976 *Turbonilla* (*Mormula*) *lanceae* (Libassi) – Marasti & Raffi, p. 196, pl. 2, fig. 9.
1989 *Turbonilla lanceae* (Libassi, 1859) – Chirli, p. 113, fig. 1.
1992 *Turbonilla lanceae* (Libassi, 1859) – Cavallo & Repetto, p. 162, fig. 462.
1997 *Turbonilla lanceae* (Libassi) – Ruiz Muñoz, p. 186, pl. 40, fig. 20.
1998 *Turbonilla striatula* (L. 1758) – Bogi & Cauli, p. 130, fig. 8 (*non* Linnaeus, 1758).
2010 *Turbonilla lanceae* (Libassi, 1859) – Sosso & dell'Angelo, p. 53, unnumbered fig. p. 67 bottom third from left.
2011 *Turbonilla striatula* (Linnaeus, 1758) – Landau *et al*., p. 41, pl. 22, fig. 16 (*non* Linnaeus, 1758).
2011 *Turbonilla lanceae* (Libassi, 1859) – Chirli & Micali, p. 87, pl. 31, figs 1-6.
2011 *Turbonilla lanceae* (Libassi, 1859) – Chirli & Linse, p. 208, pl. 82, fig. 2.
2013 *Turbonilla lanceae* (Libassi, 1859) – Landau *et al*., p. 316, pl. 52, fig. 10.
2016 *Turbonilla lanceae* (Libassi, 1859) – Bellagamba

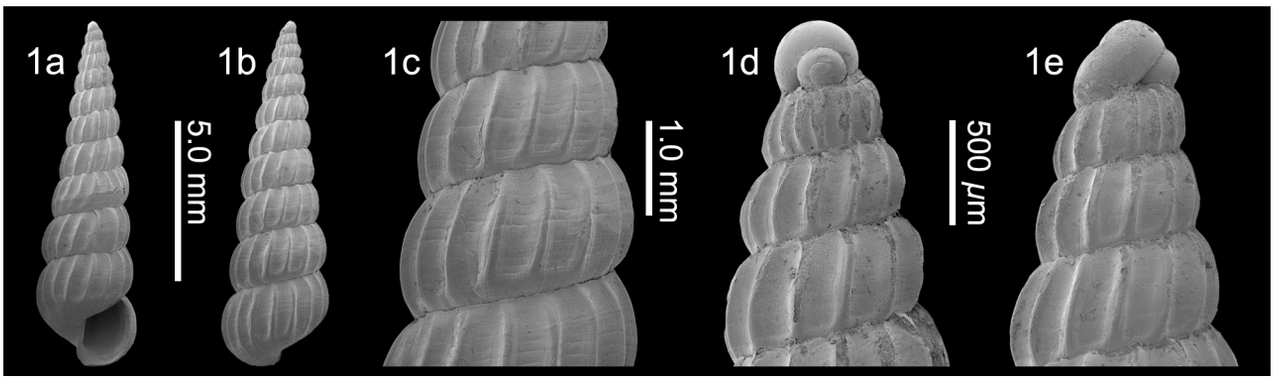

Plate 123. *Pyrgostylus lanceae* (Libassi, 1859); 1. NHMW 2019/0167/0130, height 10.0 mm, width 2.8 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

& Micali, p. 143, figs 4D-E.

2018 *Mormula lanceae* (Libassi, 1859) – Brunetti & Cresti, p. 114, fig. 509.

2020 *Pyrgostylus lanceae* (Libassi, 1859) – Landau *et al*., p. 336, pl. 65, figs 1-3.

Material and dimensions – Maximum height 13.7 mm, width 4.2 mm. **CO**: NHMW 2019/0167/0192 (37). **VC**: NHMW 2019/0167/0130 (1), NHMW 2019/0167/0131 (12). **VS**: NHMW 2019/0167/0858 (1). **EL**: NHMW 2019/0167/0111 (15).

Discussion – The *Pyrgostilus striatulus* (Linnaeus, 1758) – *P. lanceae* (Libassi, 1859) species complex is problematic. Micali (1994) suggested they were conspecific, with modifications occurring in protoconch size and shape since the Pliocene, suggesting a shortening of the planktotrophic stage. However, Chirli & Micali (2011) again separated the two species, and considered both to be present in the late Miocene and Pliocene of Italy. *Pyrgostylus lanceae* was said to differ from *P. striatulus* in having a taller protoconch, a less slender shell, the spire whorls having a more drop-shaped profile, the suture being more superficial and more inclined and, most importantly, the axial ribs do not touch the abapical suture (Chirli & Micali, 2011, p. 88). The protoconch dimensions of the two are different: present-day *P. striatulus* has a compact protoconch type A1 (dp = 375 μm), with the nucleus only slightly protruding (Peñas *et al.,* 1996 fig. 158), whereas in *P. lanceae* the protoconch is type A2, very long, the apex surpassing the profile of the first teleoconch whorl.

Peñas & Rolán (1997, p. 52) added a further extant West African taxon to the species complex, *P. martae*, and stated in their discussion that their new species was very similar to the Pliocene form [*P. lanceae*] and mantained the same A-type protoconch. They continue "*Por el contrario,* -T. martae *evolucionó, pero sus cambios no incluyeron el del tipo de protoconcha que, en la actualidad, sigue conservando la del tipo A* [in contrast, *T. martae* evolved, but its changes did not include a change in protoconch type which, in the present-day, conserves the type A]" (Peñas & Rolán, 1997, p. 52). However, no explicit comparison with *P. lanceae* was offered because they referred to Micali (1994), where only the name *P. striatulus* was used.

As understood here, *P. lanceae* is characterised by its large slender shell, type A2 protoconch, with 2.25 whorls, nucleus fully exposed (Estepona specimen; dp = 370 μm; hp = 400 μm, dn = 95 μm, tilted at about 117° to main shell axis), teleoconch of up to 14 low, strongly convex whorls, separated by a deeply impressed slightly undulating suture, sculpture of very narrow, opisthocline ribs that do not reach the abapical suture, but end at an indistinct suprasutural cord, 16-20 on the penultimate whorl, and flattened spiral cords separated by narrow grooves present in axial interspaces. The occasional rib on late teleoconch whorls is varicose. The last whorl is low, strongly convex, the ribs ending at the periphery merging into a poorly delimited basal disc, the base is imperforate, with 12-15 fine spiral grooves. The protoconch height of about 400 μm is consistent with that given for the upper Pliocene specimens by Micali (1994), and smaller that the lower Pliocene specimens, with a protoconch height of about 500 μm. Further examination of specimens from various Italian Pliocene localities revealed a form similar to that found in Estepona, sharing a very long protoconch (length up to about 425 μm) and a diameter of 380-425 μm, found at Rio Torsero and Altavilla. The protoconch diameter and elongate form well fits with the extant West African *T. martae*. We provisionally consider these Estepona specimens to fit within the intraspecific variability of *P. lanceae*. A more detailed examination of protoconch morphometrics of samples from extant and fossil populations is required to conclude if the two are conspecific.

Distribution – Middle Miocene: northeastern Atlantic (Langhian): Loire Basin, France (Glibert, 1949a); Proto-Mediterranean (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian), NW France (Landau *et al*., 2020); central Proto-Mediterranean Italy (Sacco, 1892b). Lower Pliocene: Atlantic, Guadalquivir Basin, Spain (Ruiz Muñoz, 1997; Landau *et al*., 2011); central Mediterranean, Italy (Chirli,

1989; Guioli *et al*., 2009; Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: Atlantic, Mondego Basin, Portugal (NHMW collection) western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Sacco, 1892b; Marasti & Raffi, 1976; Chirli, 1989; Cavallo & Repetto, 1992; Bogi & Cauli, 1998; Ferrero *et al*., 2005; Sosso & dell'Angelo, 2010; Bellagamba & Micali, 2016). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914); eastern Mediterranean, Rhodes (Chirli & Linse, 2011).

***Pyrgostylus striatulolanceae* (Sacco, 1892)**
Plate 124, figs 1-3

*1892b	*Turbonilla* (*Pyrgostylus*) *striatulolanceae*	Sacco, p. 10 [pl. 2, fig. 141; 1892a].
1892b	*Turbonilla* (*Pyrgostylus*) *striatulolanceae* var. *pyramidalis*	Sacco, p.10 [pl. 2, fig. 142; 1892a].
1892b	*Turbonilla* (*Pyrgostylus*) *striatulolanceae* var. *striatuloides*	Sacco, p. 10 [pl. 2, fig. 143; 1892a].
1969	*Pyrgostylus striatulolanceae*	Sacco – Fekih, p. 44, pl. 8, fig. 6.
1969	*Pyrgostylus striatulolanceae* var. *pyramidalis*	Sacco – Fekih, p. 44, pl. 8, fig. 7.
1984	*Turbonilla* (*Pyrgostylus*) *striatulolanceae*	Sacco, 1892 – Ferrero Mortara *et al*., p. 86, pl. 13, fig. 11.

Material and dimensions – Maximum height 16.4 mm, width 3.5 mm. **VC**: NHMW 2019/0167/0122 (19), NHMW 2019/0167/0538-0539 (2). **PQ**: NHMW 2019/0167/0070 (1), NHMW 2019/0167/0071 (1). **EL**: NHMW 2019/0167/0723 (4).

Discussion – The differences given by Sacco (1892b) between *Pyrgostylus striatulolanceae* (Sacco, 1892) and *P. lanceae* (Libassi, 1859) seem minor "*Testa affinis* P. Lanceae*, sed differtur sequentibus notis: Cingulum, circumbasale suboblitum vel nullum, deinde spatia intercostalia inferne non circumscripta. Costae longitudinales in regionem basalem passim subproductae.* [similar to *P. lanceae*, from which it differs in having a: peribasal cord very weak or absent, interspaces not closed at periphery. Axial ribs slightly extending over the base]" (Sacco, 1892b, p. 10). However, the protoconch of *P. lanceae* is of type A2 (Chirli & Micali, 2011, pl. 31, fig. 4; Pl. 123, fig 1c), wheras that of *P. striatulolanceae* is of type B (Pl. 124, fig. 1d). Unfortunately, the syntype illustrated by Ferrero Mortara *et al*. (1984, pl. 13, fig. 11) is an apertural fragment missing its apex, but specimens at hand from the Pliocene of Italy (PM coll.) confirm these differences.

The form of *P. striatulus* distributed in the Gulf of Gabes, described as *Turbonilla mirifica* Pallary, 1904 (syntype figured in Giannuzzi-Savelli *et al*., 2014, fig. 275) shows an outline similar to *P. striatulolanceae*, but differs in having a smaller protoconch (dp= 300 μm vs 400-430 μm), less convex whorls, a greater number of ribs (23-25) that are more opisthocline, flexuose, separated by narrower and shallower interspaces. The typical *P. striatu-*

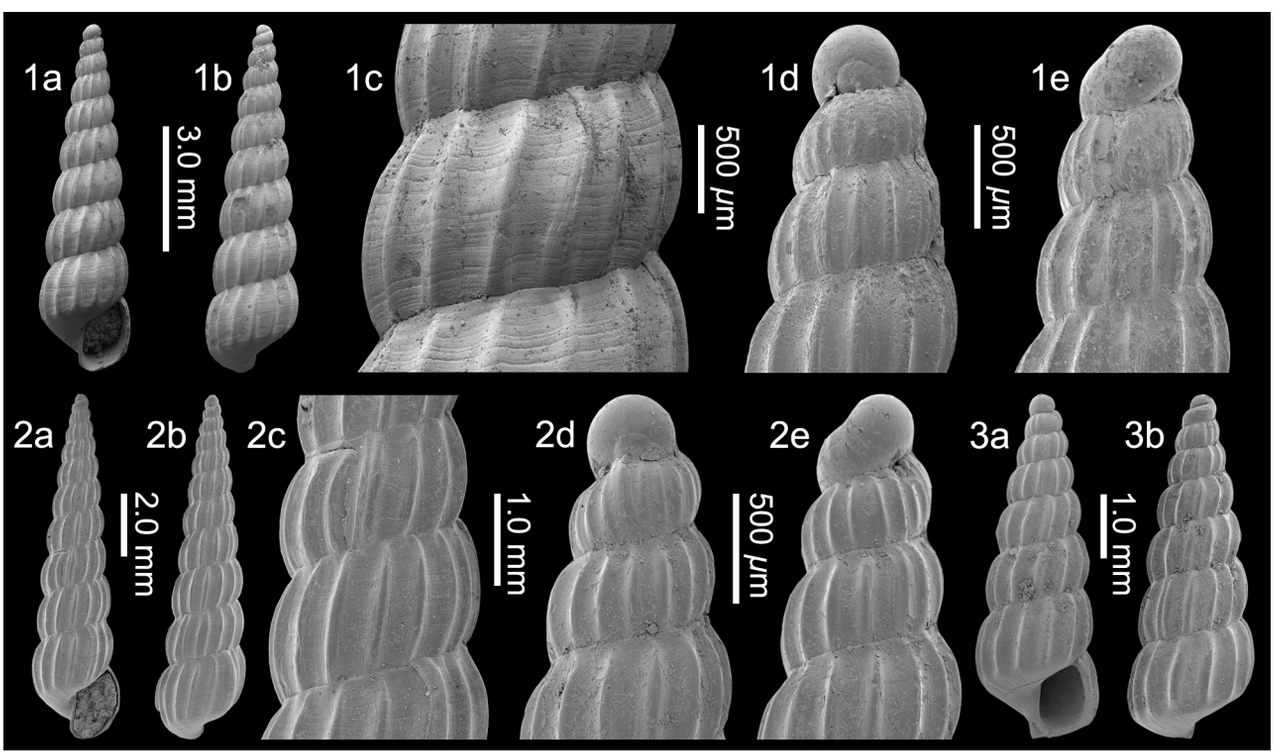

Plate 124. *Pyrgostylus striatulolanceae* (Sacco, 1892); 1. NHMW 2019/0167/0070, height 9.0 mm, width 2.0 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch. Parque Antena. 2. NHMW 2019/0167/0538, height 11.0 mm, width 2.7 mm, 2c, detail of sculpture last two spire whorls, 2d-e, detail of protoconch; 3. NHMW 2019/0167/0539, height 5.3 mm, width 1.9 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

lus has a protoconch of similar size (dp = 365-380 μm), but differs in having a slower growth rate (*i.e.* 6 against 5 whorls at the same height), having flatter teleoconch whorls (difference much more evident in the initial teleoconch whorls), a much deeper suture resulting from slightly gradate whorls, stronger ribs, separate by narrower interspaces, and the presence of varices.

Distribution – Lower Pliocene: western Mediterranean, Tunisia (Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892b; Ferrero Mortara *et al*., 1984).

Genus *Strioturbonilla* Sacco, 1892

Type species – *Odostomia sigmoidea* Monterosato, 1880, by original designation, present-day, Strait of Gibraltar.

1892a *Strioturbonilla* Sacco, p. 94.

Note – Sacco (1892a) chose *Odostomia sigmoidea* Monterosato, 1880 as type species for his genus *Strioturbonilla*, although he gave the author of the species as Jeffreys. Jeffreys (1884, p. 354) considered it a Monterosato manuscript name (for authorship see Amati, 1986).
In Sacco's description he characterised the subgenus as having an outline like *Turbonilla*, but with spiral striae present in interspaces and passing over the ribs, the ribs attenuated towards the base, no peribasal cord, and a convex base. He placed in this subgenus species like *Turbonilla* (*Strioturbonilla*) *alpina* Sacco, 1892 and *Turbonilla* (*Strioturbonilla*) *miocrassulata* Sacco, 1892, which are quite different from the type of the genus. In the selection of genotype Sacco was possibly mislead by Jeffreys's drawing (1884, pl. 26, fig. 9), showing an outline like a *Turbonilla*, while *Odostomia sigmoidea* is quite different from a *Turbonilla*. It differs from Italian Neogene species placed by Sacco (1892a) in '*Strioturbonilla*' in having a much thinner shell, a large strongly intorted protoconch, teleoconch with strongly convex whorls separated by a deep suture and strongly sinuous axial ribs. Indeed it bears more similarity to *Parthenina* or *Chrysallida*, where it has been placed by recent authors (Schander, 1994, fig. 2f; Peñas *et al*., 1996, fig. 17; Chirli & Micali, 2011, pl. 13, fig. 11-15 [as *Chrysallida* aff. *sigmoidea*]).
Dall & Bartsch (1904, p. 7) erroneously indicated *Turbonilla* (*Strioturbonilla*) *alpina* Sacco, 1892 as the type species. This was followed by Cossmann (1921, p. 281) and Wenz (1940, p. 870). Cossmann (1921, p. 281) noted that Sacco placed different forms in this genus, stating that "*l'auteur a classé dans cette Section des formes très hétérogènes!*".
We do not know if the change of Sacco's type species suggested by Dall & Bartsch (1907, p. 495) was a *lapsus*, or the authors recognised that the species included by Sacco had little in common with *O. sigmoidea*, but it is inadmissible (ICZN, 1999, Art. 67.5).

'*Strioturbonilla*' *sensu* Cossmann, 1921

During the preparation of this monograph we attempted to characterise a group of species that have historically been placed in '*Strioturbonilla*' *sensu* Cossmann, 1921. This group is characterised by rather solid turbonillid shells with strong axial ribs that do not persist onto the base, but do not end abruptly at a basal disc, as in members of the genus *Chemnitzia* d'Orbigny, 1840, and have very fine crowded spirals that are well-developed both over the ribs and in the axial interspaces giving the surface a somewhat undulating appearance, more numerous and regular than in the genus *Pyrgiscus* Philippi, 1841, that continue over the base (Cossmann 1921, p. 281).
This type of sculpture is not common in European fossil turbonillids, and in Estepona only *Turbonilla multilirata* Monterosato, 1875 would be included, which is very similar to the 'type species' *T.* (*S.*) *alpina*, a poorly known species based on a fragment (holotype figured by Ferrero Mortara *et al*., 1984, pl. 13, fig. 9). In Europe the only extant species is *T. multilirata*. This group does not seem to be represented in the present-day West African fauna, whereas it is better represented in the Red Sea [*Turbonilla stegastris* Melvill & Standen, 1901 and *T.* (*Pyrgostelis*) *charbarensis* Melvill & Standen, 1901 from the Gulf of Oman].
However, spiral sculpture is present in many other turbonillids (*Pyrgiscus* Philippi, 1841, *Pyrgisculus* Monterosato, 1884 and *Pyrgostylus* Monterosato, 1884), and the character of this sculpture is discussed under their generic notes. Yet other species also have spiral sculpture consisting of very fine spiral striation covering the full whorl height [*e.g.*, *T. andaluciensis* nov. sp., *T. fulgidula* (Jeffreys, 1884), *T. tabanellii* Bongiardino & Micali, 2018, *T. pliocostellatoides* Sacco, 1892] or fewer and/or more irregular fine spirals, variable in number and spacing (*e.g.*, *T. ligusticorerebralis* Sacco, 1892, *T. dautzenbergi* Glibert, 1949, *T. pliocolligens* Sacco, 1892). We believe this to be a secondary sculptural character that is not of generic value, and also occurs occasionally in species within other groups of pyramidellids, such as *Odostomia* Fleming, 1813 (*e.g.*, *O. striolata* Forbes & Hanley, 1850), *Eulimella* [*e.g.*, *E. scillae* (Scacchi, 1835)] and in many *Ondina* de Folin, 1870 species. These fine striations are sometimes seen in some populations/habitats [*e.g.*, *Eulimella acicula* (Philippi, 1836)], or may appear randomly in some specimens within a species [*e.g.*, *Parthenina monozona* (Brusina, 1869), *Turbonilla pumila* Seguenza, 1876]. A further genus *Pyrgolampros* Sacco, 1892 may also have spiral sculpture. The original description indicates "*Sulculi transversi nulli, vel parvillimi, sub lente vis passim visibiles* [Spiral grooves missing or very fine, visible here and there under a magnifier lens]". Therefore spiral striation may be present or absent and are not enough to characterise the genus (see generic note under *Turbonilla* Risso, 1826).
We were unable to adequately characterise '*Strioturbonilla*' *sensu* Cossmann, 1921, and those species are here included in *Turbonilla* (*sensu lato*).

***Strioturbonilla sigmoidea* (Monterosato, 1880)**
Plate 125, figs 1-2

*1880	*Odostomia sigmoidea* Monterosato, p. 71.
1977	*Chrysallida sigmoidea* (Monterosato) – Van Aartsen, p. 54, pl. 1, fig. 9.
1986	*Chrysallida sigmoidea* (Monterosato, 1880) – Amati, p. 64, fig. 1.
1992	*Chrysallida sigmoidea* (Monterosato, 1880) – Cavallo & Repetto, p. 154, fig. 426.
1992	*Chrysallida sigmoidea* (Monterosato, 1880) – Van der Linden & Eikenboom, p. 40, fig. 55.
1996	*Chrysallida sigmoidea* (Monterosato, 1880) – Peñas *et al*., p. 28, figs 16, 17.
1998	*Chrysallida sigmoidea* (Monterosato, 1880) – Peñas & Rolán, p. 55, figs 152-154.
2008	*Chrysallida* cf. *sigmoidea* (Monterosato, 1880) – Chirli & Micali, p. 42, figs O-P.
2011	*Chrysallida sigmoidea* (Monterosato, 1880) – Chirli & Micali, p. 42, pl. 13, figs 6-10.
2014	*Chrysallida sigmoidea* (Monterosato, 1880) – Giannuzzi-Savelli *et al*., p. 74, fig. 223, appendix p. 25, 72.

Material and dimensions – Maximum height 3.1 mm, width 970 μm. **CO**: NHMW 2019/0167/0719 (2). **EL**: NHMW 2019/0167/0563-0564 (2), NHMW 2019/0167/0565 (10).

Discussion – *Strioturbonilla sigmoidea* (Monterosato, 1880) is characterised by its elongated, conico-cylindrical profile with a truncated apex, type B tending to C protoconch, teleoconch of up to six weakly convex whorls, separated by a deeply impressed suture, sculpture of 18-20 orthocline sinuous axial ribs, separated by interspaces narrower than the ribs, and very fine spirals that persist onto the base. The last whorl is rounded at the base, the axials end relatively abruptly above the base, that bears a very narrow umbilical chink, and the columella is smooth, without a fold.
Chemnitzia curvicostata Wood, 1848, described from the lower Pliocene Coralline Crag of England, is similar to *S. sigmoidea* and has been recorded in the Italian Pliocene (Pavia, 1976; Chirli & Micali, 2008, 2011; *inter alia*). Bellagamba & Micali (2016, p. 142, figs U, V) illustrated specimens from the Pliocene of Italy and stated that it differed from *S. sigmoidea* in having finer and more numerous ribs and lacking spiral sculpture in the axial interspaces. The number of ribs in the Italian specimen illustrated by those authors seems similar to that of the Estepona specimens and the spiral threads may not be preserved in worn shells. We provisonally separate the two species, however, if they were conspecific Wood's name would have priority. A direct comparison with Wood's type material would be necessary to confirm if the two are distinct. Unfortunately, no English Pliocene material is available to us.

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Cavallo & Repetto, 1992; Crovato & Micali, 1992b; Chirli & Micali, 2008, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic from France to Angola (Van Aartsen *et al*., 2000; Peñas & Rolán, 1998), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Giannuzzi-Savelli *et al*., 2014).

Genus *Turbonilla* Risso, 1826

Type species – *Turbonilla costulata* Risso, 1826, by subsequent designation (Herrmannsen, 1852), Pleistocene, France.

1826	*Turbonilla* Risso, p. 224.
1972a	*Magniturbonilla* Nordsieck, p. 128. Type species (by original designation): *Turbonilla speciosa* H. Adams, 1869, present-day, eastern Atlantic.

Note – Species included in this group have strong axial sculpture that that does not stop abruptly at a basal disk, as in *Chemnitzia,* but rather fading out, whether extending onto the base or ending at or above the periphery, and no spiral sculpture (Dall & Bartsch, 1904, p. 11). We have used this genus in a broader sense and include species with spiral sculpture not placed in other genera (*e.g.*, *Pyrgiscus* Philippi, 1841, *Pyrgostylus* Monterosato, 1884).

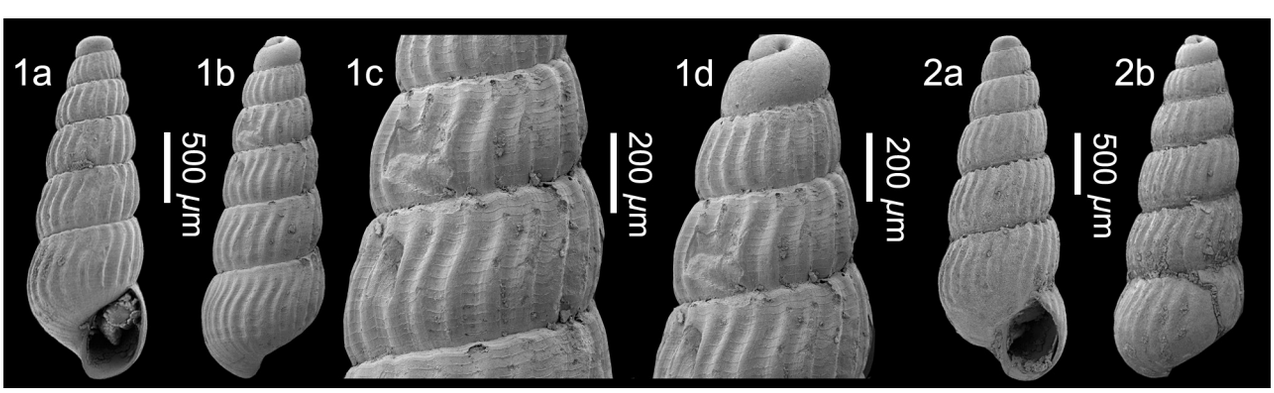

Plate 125. *Strioturbonilla sigmoidea* (Monterosato, 1880); 1. NHMW 2019/0167/0563, height 2.4 mm, width 830 μm, 1c, detail of sculpture last two spire whorls, 1d, detail of protoconch; 2. NHMW 2019/0167/0564, height 3.0 mm, width 1.0 mm (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

We have also included species placed in the subgenus *Pyrgolampros* Sacco, 1892. Sacco (1892a, p. 85) described members of this group as having rather large shells, with flat-sided or weakly convex whorls, rounded ribs that are crowded, numerous, in some species weakening on the last whorl, spiral sculpture absent, or very weak and visible only under magnification, aperture subquadrate, external lip sometimes internally denticulate, outside simple, columella often with strong fold. He further commented that some species were similar to *Strioturbonilla* Sacco, 1892 (*partim*, *sensu* Cossmann, 1921; see generic note under *Strioturbonilla*). The generic description given by Sacco is rather broad and *Pyrgolampros* does not form a well-defined group based on shell characters. We therefore include them in *Turbonilla* Risso, 1826, but do not suggest this forms a monophyletic group.

To further complicate matters, *Pyrgolampros* must be considered a *nomen nudum*, as Sacco's work was serialized, each part must be dated separately (ICZN Code 1999). *Pyrgolampros* was published in April, 1892, but the originally designated type, *Turbonilla* (*Pyrgolampros*) *mioperplicatus* was not published until June, 1882. Neither of the two available originally included species have been subsequently designated type. We prefer not to make a designation here. Moreover, this genus has been misspelled several times in the literture [*Pyrgolamprus* O. Boettger, 1902 (unjustified emendation), repeated by Cossmann, 1921; *Pyrgolambros* Kobelt, 1903 (incorrect subsequent spelling); *Pyrogolampros* Dall & Bartsch, 1910 (incorrect subsequent spelling), repeated by B. Marshall, 1991; *Pyrgolampsus* Toula, 1911 (incorrect subsequent spelling)] (Patrick Lafollette personal communication BL October 2021). As we cannot characterise this genus we have excluded it from the generic synonymy.

***Turbonilla acutissima* Monterosato, 1884**
Plate 126, fig. 1

*1884 *Turbonilla acutissima* Monterosato, p. 92.
1981 *Turbonilla acutissima* Monterosato, 1884 – Van Aartsen, p. 71, 76, pl. 4, fig. 24.
1996 *Turbonilla acutissima* Monterosato, 1884 – Peñas *et al*., p. 59, figs 185, 186.
2001 *Turbonilla acutissima* Monterosato, 1884 – Cachia *et al*., p. 111, pl. 18, fig. 3.
2004 *Turbonilla acutissima* Monterosato, 1884 – Solustri & Micali, p. 68, fig. 5m.
2011 *Turbonilla acutissima* Monterosato, 1884 – Chirli & Micali, p. 71, (pl. 25, figs 6-12; *lapsus*), corrected to pl. 25, figs 13-18.
2013 *Turbonilla acutissima* Monterosato, 1884 – Öztürk & Bitlis Bakir, p. 430, fig. 15.
2014 *Turbonilla acutissima* Monterosato, 1884 – Giannuzzi-Savelli *et al*., p. 78, figs 239, 240, appendix p. 28, 75.
2018 *Turbonilla acutissima* Monterosato, 1884 – Trigo *et al*., p. 363, fig . 39.

Material and dimensions – Maximum height 3.4 mm, width 920 μm. **CO**: NHMW 2019/0167/0304 (1), NHMW 2019/0167/0305 (1). **EL**: NHMW 2019/0167/0730 (1).

Discussion – *Turbonilla acutissima* Monterosato, 1884 is characterised by its slender, elongated shell, type A2 protoconch, 2.25 whorls exposed, with prominent nucleus (Estepona specimen; dp = 220 μm, hp = 230 μm, tilted at about 110° to main shell axis), up to 12 almost straight-sided teleoconch whorls, separated by a relatively deep undulating suture, sculpture of 18-20 strong, rounded, slightly curved, opisthocline ribs, equal in width or slightly wider than their interspaces, ribs on last whorl end relatively abruptly at the base, without forming a well-defined basal disc, the base is smooth, umbilicus and columellar fold are absent.

Turbonilla astensidelicata Sacco, 1892 is closely similar to *T. acutissima*, but differs in having a more cylindrical profile, slightly smaller protoconch (200-220 μm vs 250 μm for *T. astensidelicata*), fewer (16-18), narrower axial ribs separated by wider interspace, and a more deeply undulating suture around the prominent adapical end of the ribs.

Turbonilla subulina Monterosato, 1889 is quite variable (see Peñas & Rolán, 1997; Peñas *et al*., 2014), however it differs for having narrower, reversed S-shaped ribs in-

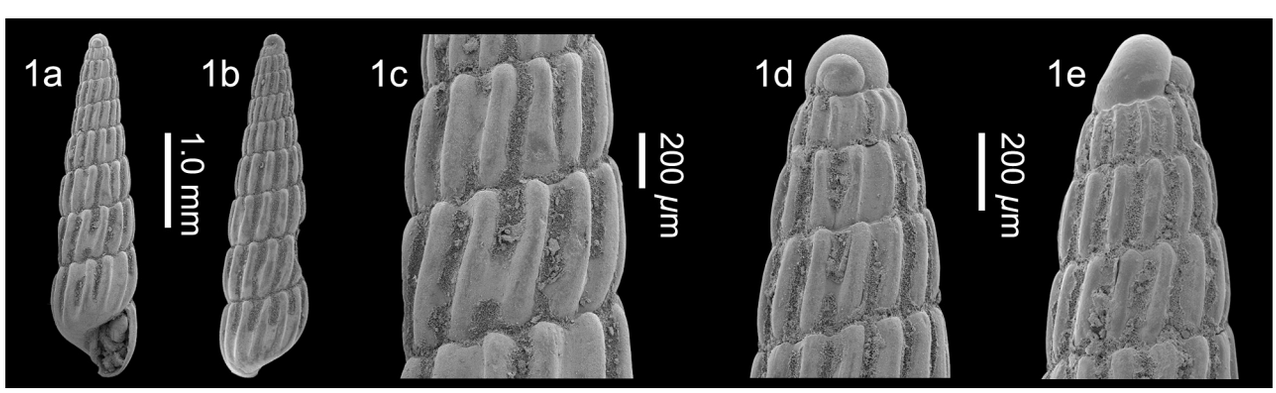

Plate 126. *Turbonilla acutissima* Monterosato, 1884; 1. NHMW 2019/0167/0304, height 3.4 mm, width 920 μm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Estepona, lower Piacenzian, upper Pliocene.

stead of straight ribs. *Turbonilla pusilla* (Philippi, 1844) is similar, but *T. acutissima*, but has a more helicoid protoconch, with the apex protruding slightly from the profile of the first teleoconch whorl, regularly conical spire, and the ribs are stronger, more extended adapically, deeply undulating the suture.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, northwestern Spain (Trigo *et al*., 2018), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001), eastern Mediterranean, Turkey (Öztürk & Bitlis Bakir, 2013; Öztürk *et al*., 2014). Not present in West Africa (Peñas & Rolán, 2000).

***Turbonilla amoena* (Monterosato, 1878)**
Plate 127, figs 1-2

1875 *Odostomia* (*Turbonilla*) *venusta* Monterosato, 1875 (*non* Issel, 1869).
*1878a *Odostomia amoena* Monterosato, p. 94. (*nom. nov. pro O. venusta* Monterosato, 1875, *non* Issel, 1869).
1884 *Odostomia compressa* Jeffreys, p. 360, pl. 27, fig. 5.
1981 *Turbonilla compressa* (Jeffr.) – Van Aartsen, p. 67, fig. 9.
1993 *Turbonilla amoena* (Monterosato, 1878) – Carroza & Nofroni, p. 97, figs 2-4.
1997 *Turbonilla amoena* (Monterosato, 1878) – Peñas & Rolán, p. 5.
2001 *Turbonilla amoena* (Monterosato, 1878) – Cachia *et al*., p. 111, pl. 18, fig. 4.
2005 *Turbonilla amoena* (Monterosato, 1878) – Rolán, p. 196, fig. 900.
2014 *Turbonilla amoena* (Monterosato, 1878) – Giannuzzi-Savelli *et al*., p. 78, fig. 241, appendix p. 28, 76.
2018 *Turbonilla amoena* (Monterosato, 1878) – Brunetti & Cresti, p. 110, fig. 482.

Material and dimensions – Maximum height 8.0 mm, width 2.1 mm. **CO**: NHMW 2019/0167/0451 (3). **VC**: NHMW 2019/0167/0276 (1), NHMW 2019/0167/0277 (9), NHMW 2019/0167/0578 (19).

Discussion – *Turbonilla amoena* (Monterosato, 1878) is characterised by its slender shell, elongate-conical profile, large type B protoconch, just under 2.25 whorls, with the nucleus almost completely exposed (Estepona specimen; dp = 360-380 μm, hp = 325-340 μm, tilted at about 130° to main shell axis), teleoconch of up to nine straight-sided whorls, later whorls slightly pinched adapically, separated by a weakly impressed suture, sculpture of 18-19 low, poorly defined, orthocline ribs, slightly narrower than their interspaces, fine growth lines visible in axial interspaces, last whorl slightly pinched adapically, weakly inflated abapically, rounded at the base, the ribs weakening before the periphery, aperture pyriform, outer

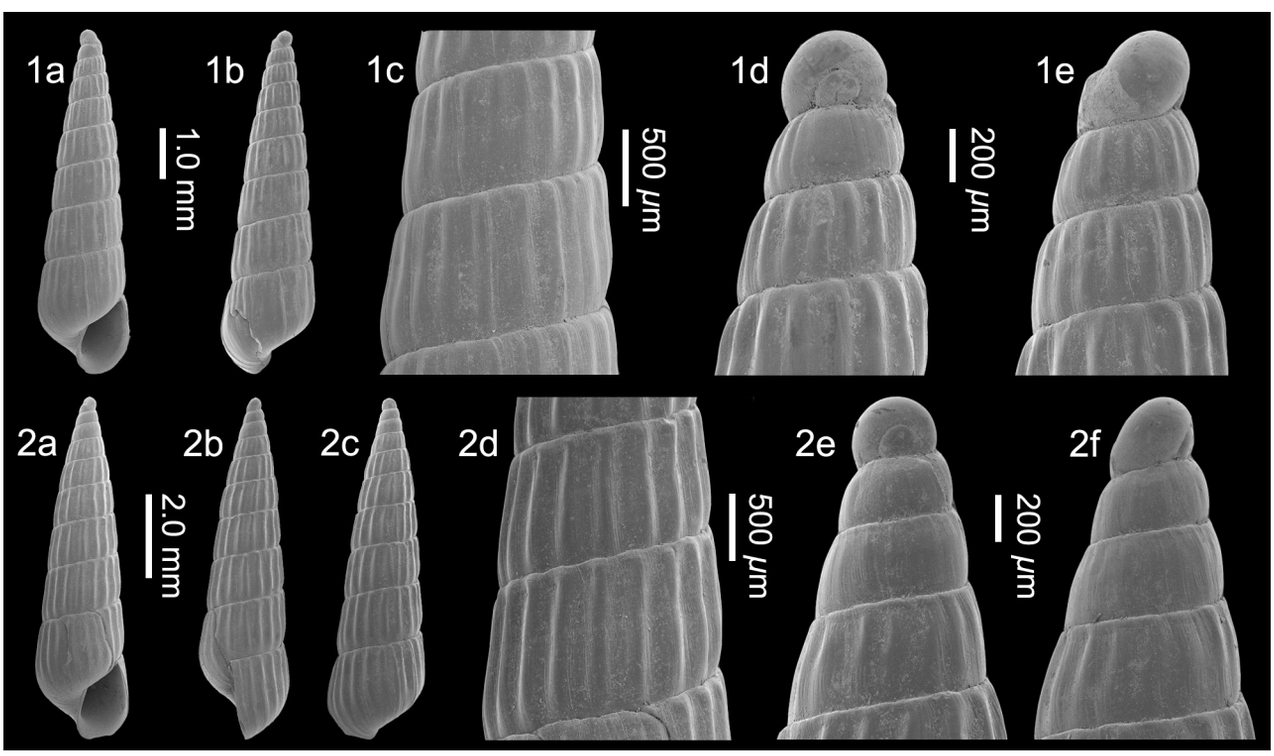

Plate 127. *Turbonilla amoena* (Monterosato, 1878); 1. NHMW 2019/0167/0276, height 6.7 mm, width 1.8 mm, 1c, detail of teleoconch sculpture last two whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0587, height 8.0 mm, width 2.1 mm, 2c, detail of teleoconch sculpture last two whorls, 2d-e, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

lip slightly flared abapically, and the columella is slightly oblique, without a fold. The shells illustrated here from the Velerín carretera deposit are closely similar to the largest specimen illustrated by Carroza & Nofroni (1993, fig. 4). We have not found any SEM image of the protoconch of extant specimens to compare, but it is large and similarly tilted in the specimen illustrated by Giannuzzi-Savelli *et al*. (2014, fig. 241). The shell profile is similar to that of *Turbonilla plicatulosenensis* (Sacco, 1892), which differs in having the whorls slightly angulated near the adapical suture, and fine spiral sculpture overrunning the ribs.

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992b; as *T. compressa*; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Azores (Jeffreys, 1884), Canary Islands (Hernández et al., 2011), Cape Verde Islands (Rolán, 2005), central Mediterranean (Carroza & Nofroni, 1993; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

***Turbonilla astensidelicata* Sacco, 1892**
Plate 128, fig. 1

*1892a	*Turbonilla astensidelicata* Sacco, p. 80, pl. 2, fig. 72.
1892a	*Turbonilla astensidelicata* var. *acutina* Sacco, p. 80, pl. 2, fig. 73.
1984	*Turbonilla astensidelicata* Sacco, 1892 – Ferrero Mortara *et al*., p. 82, pl. 12, fig. 11.
2011	*Turbonilla astensidelicata* Sacco, 1892 – Chirli & Micali, p. 72, (pl. 25, figs 13-18; *lapsus*), corrected to pl. 26, figs 1-6.

Material and dimensions – Maximum height 2.7 mm, width 810 μm. **VC**: NHMW 2019/0167/0692 (1), NHMW 2019/0167/0693 (3). **VS**: NHMW 2019/0167/0853 (1).

Discussion– *Turbonilla astensidelicata* Sacco, 1892 is characterised by its slender, elongated shell, type A2 protoconch, 2.25 whorls exposed, with prominent nucleus (Estepona specimen; dp = 250 μm, hp = 250 μm, dn = 100 μm, tilted at about 105° to main shell axis), up to 12 weakly convex teleoconch whorls, separated by a relatively deep undulating suture, sculpture of 14-18 strong, rounded, slightly curved, opisthocline ribs, equal in width to their interspaces, ribs on last whorl end relatively abruptly at the base, without forming a well-defined basal disc, the base is smooth, umbilicus and columellar fold are absent. There is some variability in the convexity of the whorls; the Estepona specimen has almost flat-sided whorls similar to the syntype (Ferrero Mortara *et al*., pl. 12, fig. 11) and the Italian specimen figured by Chirli & Micali (2011, pl. 26, fig. 6). The variety *acutina* Sacco was erected for the more elongated forms (Chirli & Micali, 2011, pl. 26, fig. 1-3). However, the two forms co-occur in the Italian Pliocene with numerous intermediates (Chirli & Micali, 2011, p. 72). The protoconch of the Estepona specimens is slightly wider than that reported by Chirli & Micali (220 μm vs 200 μm).
Turbonilla subulina Monterosato, 1889 is quite variable (see Peñas & Rolán, 1997; Peñas *et al.,* 2014), however it differs in having thinner reversed-S instead of straight ribs.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2014). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Sacco, 1892a).

***Turbonilla bincki* nov. sp.**
Plate 129, fig. 1

Type material – Holotype NHMW 2019/0167/0151, height 5.4 mm, width 1.8 mm; paratype 1 NHMW 2019/0167/0152, height 6.2 mm, width 2.0 mm; paratype 2 NHMW 2019/0167/0583, height 7.5 mm, width 2.1 mm; paratype 1 NHMW 2019/0167/0584, height 5.0 mm, width 1.7 mm.

Other material –Maximum height 7.5 mm, width 2.1 mm. **CO**: NHMW 2019/0167/0213 (4). **VC**: NHMW 2019/0167/0585 (3).

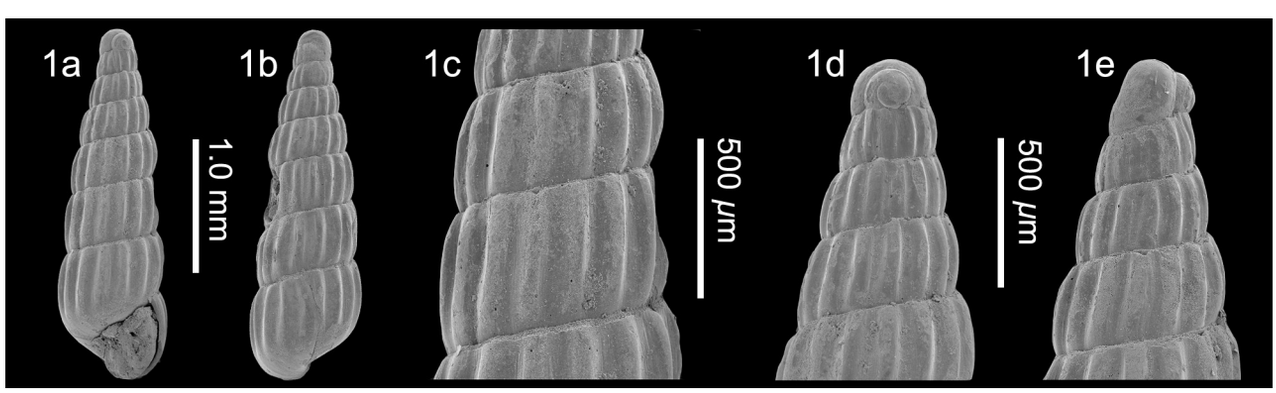

Plate 128. *Turbonilla astensidelicata* Sacco, 1892; 1. NHMW 2019/0167/0692, height 2.7 mm, width 810 μm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Estepona, lower Piacenzian, upper Pliocene.

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Binck Mulder, grandson of Henk Mulder, in recognition of Henk's help in this monograph. *Turbonilla* gender feminine.

Diagnosis – *Turbonilla* species of medium size, broad scalate spire, type B protoconch, teleoconch of six straight-sided whorls, slightly pinched in abapical half, sculpture of 15-16 broad orthocline ribs, spiral sculpture of a couple of fine, narrow grooves on mid-portion whorls.

Description – Shell medium-sized for genus, relatively short turriform, scalate spire. Protoconch type B, of just over two whorls, with the nucleus fully exposed (dp = 360 μm, hp = 300 μm, dn = 75 μm, tilted 130° to main shell axis). Teleoconch consisting up to six straight-sided whorls, slightly pinched just above mid-whorl, separated by an impressed, weakly undulating suture. Sculpture consists of 15-16 broad orthocline ribs, roughly equal in width to their interpaces. Spiral sculpture of a couple of fine, narrow grooves, most evident in the pinched adapical portion. Last whorl 44% of total height, slightly pinched adapically, rounded at periphery and base, ribs weakening at periphery, subobsolete over base. Aperture subquadrate, outer lip slightly flared abapically. Columella slightly oblique, without fold.

Discussion – *Turbonilla bincki* nov. sp. is most similar to *Turbonilla ligutiscoterebralis* var. *dimidiolaevis* (Sacco, 1892) described from the Italian Pliocene. That species is only known for the short original description and simple drawing (Sacco, 1892a, pl. 2 fig. 97). The drawing shows a fragment about 16 mm with 8 whorls, having gradate whorls, but an elongate, much slenderer outline, quite different from that seen in the new species.
Compared to congeners in the Estepona assemblages, *T. bincki* differs from *T. miopupoides* (Sacco, 1892) in having narrower, more scalate spire, producing a gradate rather than pupoid profile as seen in *T. miopupoides*, the spire whorls are pinched just above mid-whorl as opposed to weakly convex in *T. miopupoides*, and the last whorl is taller. The protoconch characters are similar. *Turbonilla pliopupoides* (Sacco, 1892) is much taller and the spire is subcylindrical and not conical. *Turbonilla miovatus* (Sacco, 1892) has an even more pupoid profile than its congeners. The protoconch characters of these four species are similar, with *P. miovatus* having the most strongly tilted protoconch of the four.
Among the present-day species from West Africa, only *Turbonilla eodem* Peñas & Rolán, 1999 from south of Azores at a depth of 420 m, shows some similarity, but differs in being smaller sized (about 3.4 against 5.4 mm, with 6 whorls), having a conical, not gradate outline, smaller protoconch (324 vs 360 μm), more superficial suture, and weaker ribs.

Distribution – Upper Miocene (Tortonian): central Mediterranean, Italy (Sacco, 1892a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla bongiardinoi* nov. sp.**
Plate 130, figs 1-3

Type material – Holotype NHMW 2019/0167/0581, height 3.2 mm, width 1.0 mm; paratype 1 NHMW 2019/0167/0484, height 2.2 mm, width 790μm; paratype 2 NHMW 2019/0167/0485, height 2.2 mm, width 785μm.

Other material – Maximum height 3.2 mm, width 1.0 mm. **CO**: NHMW 2019/0167/0488 (1). **VC**: NHMW 2019/0167/0594 (16). **EL**: NHMW 2019/0167/0726 (1).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Claudio Bongiardino of Ravenna, Italy, friend of the second author, in recognition of his contributions to malacology. *Turbonilla* gender feminine.

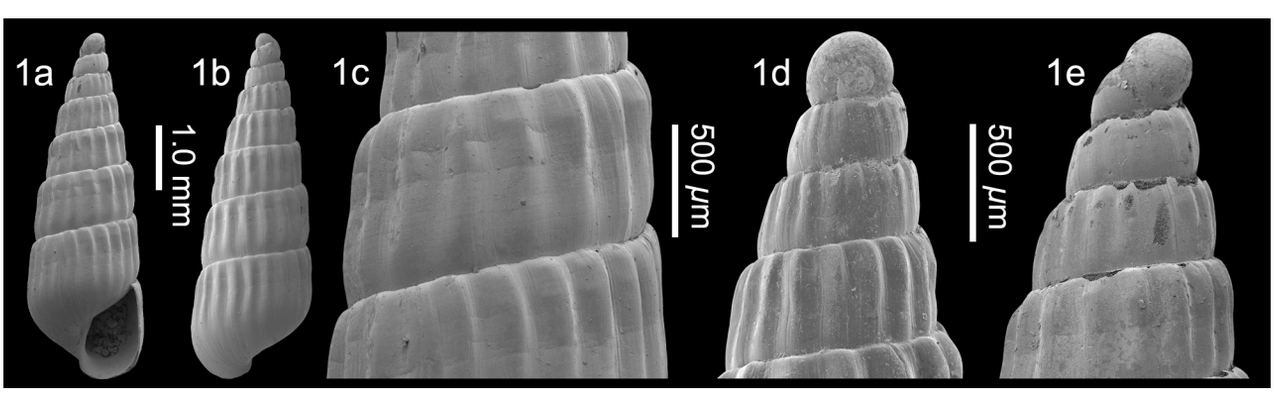

Plate 129. *Turbonilla bincki* nov. sp.; 1. **Holotype** NHMW 2019/0167/0151, height 5.4 mm, width 1.8 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

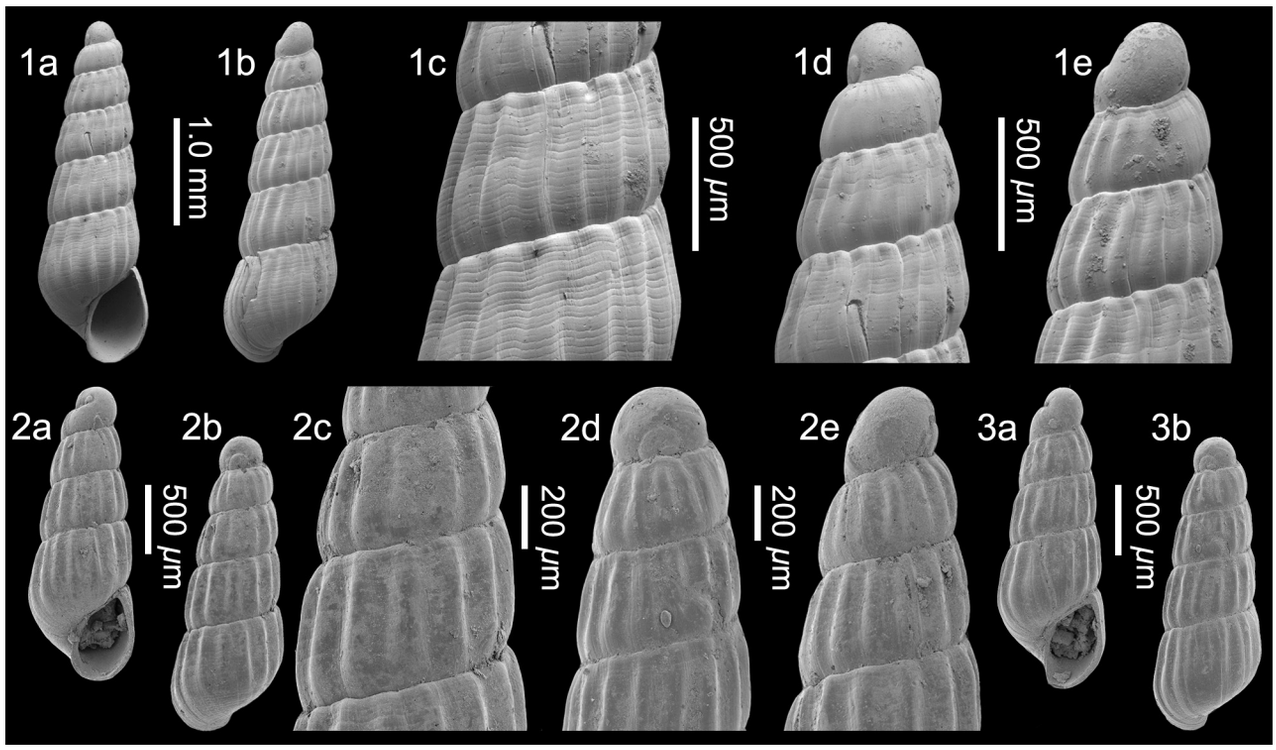

Plate 130. *Turbonilla bongiardinoi* nov. sp.; 1. **Holotype** NHMW 2019/0167/0581, height 3.2 mm, width 1.0 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0484, height 2.2 mm, width 790μm, 2c, detail sculpture last two spire whorls, 2d-e, detail of protoconch; 3. **Paratype 2** NHMW 2019/0167/0485, height 2.2 mm, width 785μm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Diagnosis – *Turbonilla* species of small size, slender conical, relatively low spired, type B protoconch, teleoconch of five whorls swollen in abapical portion, sculpture of 17 broad orthocline to slightly opisthocline ribs, fine spiral sculpture over entire whorl and overrunning ribs.

Description – Shell small for genus, slender conical, relatively low spired. Protoconch type B, of two whorls, nucleus almost completely exposed (dp = 365 μm, hp = 290-300 μm, tilted at about 123° to main shell axis). Teleoconch of five whorls swollen in the abapical half, with the periphery placed at one-third whorl height, separated by moderately impressed undulating suture. Sculpture of 14-17 rounded, orthocline to slightly opisthocline ribs, slightly narrower than their interspaces, very fine, close-set spiral sculpture covers entire whorl. Last whorl 43% of total height, slightly concave abapically, broadly rounded at periphery, ribs weakening at periphery, subobsolete over base. Aperture pyriform, 26% of total height, columella slightly oblique, without fold.

Discussion – *Turbonilla bongiardinoi* nov. sp. is closely similar to *Turbonilla tabanellii* (Bongiardino & Micali, 2018), which also occurs in the Estepona assemblages (see above), but differs in whorl profile: in *T. tabanellii* the whorls are rather square and slightly pinched mid-whorl, whereas in *T. bongiardinoi* the whorls are slenderer abapically and markedly swollen adapically. Moreover, the axial ribs in *T. tabanellii* are strenghtened at the adapical suture, whilst in *T. bongiardinoi* they are weakened.

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

***Turbonilla concinna* Pantanelli, 1884**
Plate 131, figs 1-2

*1884	*Turbonilla concinna* Pantanelli, p. 27.
2011	*Turbonilla* cf. *concinna* Pantanelli, 1884 – Chirli & Micali, p. 75 (pl. 27, figs 2-5; *lapsus*), corrected to pl. 27, figs 8-11 (*cum syn*.).

Material and dimensions – Maximum height 8.2 mm, width 1.7 mm. **CO**: NHMW 2019/0167/0169 (1). **VC**: NHMW 2019/0167/0518 (1), NHMW 2019/0167/0519 (1), NHMW 2019/0167/0533 (1).

Discussion – This species is characterised by its tall slender shell composed of 9-11 initially concave, abapically almost straight-sided whorls and slightly pinched mid-portion, separated by a deeply impressed undulating suture. The protoconch is type A1, 2.25 whorls, with the nucleus fully exposed (Estepona specimen; dp = 370-375 μm, hp = 310-320 μm, dn = 70 μm, tilted at about 110° to main shell axis). Sculpture consists of 15-19 weakly opisthocline ribs, slightly arched, roughly half the width of their interspaces that persist onto the base. Some fine interrupted or

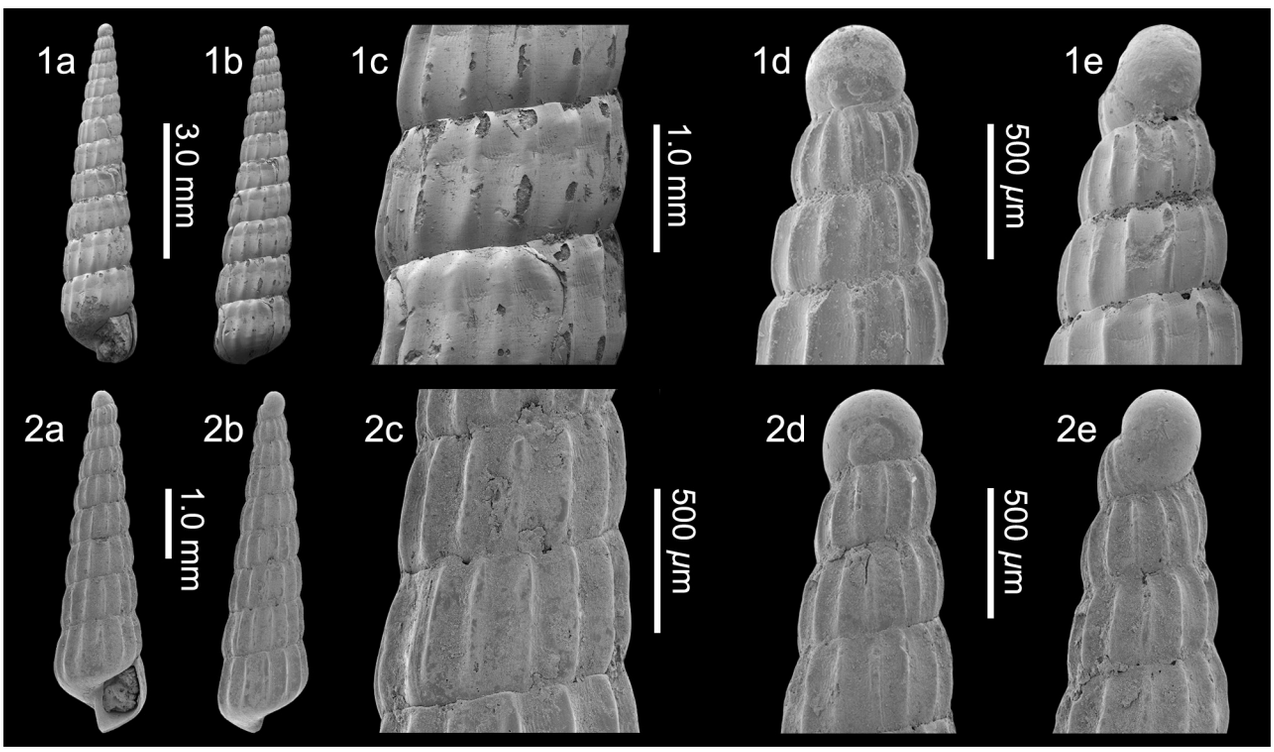

Plate 131. *Turbonilla concinna* Pantanelli, 1884; 1. NHMW 2019/0167/0169, height 8.2 mm, width 1.7 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch. Velerín conglomerates. 2. NHMW 2019/0167/0533, height 5.0 mm, width 1.4 mm, 2c, detail of teleoconch sculpture last two teleoconch whorls, 2d-e, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

irregular spiral grooves are present on the adapical half of the whorls. Chirli & Micali (2011, p. 75) discussed the difficulty in interpreting Pantanelli's description without a figure, especially as it seems exceedingly uncommon in the Italian assemblages. The specimens from Estepona figured (Pl. 131, figs 1, 2) are undoubtedly conspecific with that illustrated by Chirli & Micali (2011, pl. 27, figs 8-12) from the lower Pliocene of Italy, and shows that the species had a wide Mediterranean Pliocene disribution. Requests for information (November 24th, 2020) to the Natural History Museum in Modena concerning type material from the Pantanelli collection remain unanswered. Therefore this specimens illustrated here represent our interpretation of *T. concinna*.

The Miocene *Turbonilla costellatoides* Sacco, 1892 shows some similarity, and in particular with its variety *dertocolligens*, figured in Ferrero Mortara *et al*. (1984, pl. 12, fig. 4), but that species differs in having a more cylindrical profile and more convex whorls.

A similar conical outline and acute ribs is also found in *Chemnitzia pliomagna* (Sacco, 1892), *C. pseudocostellata* (Sacco, 1892), *C. costellata* (Grateloup, 1828) and related species. However, in all these species the ribs terminate peribasal disc, placing them in the genus *Chemnitzia* d'Orbigny, 1840 rather than *Turbonilla* Risso, 1826.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2014). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla crovatoi* nov. sp.**
Plate 132, fig. 1

2018 *Turbonilla dertogracilis* (Sacco, 1892) – Brunetti & Cresti, p. 110, fig. 485 (*non* Sacco, 1892a).

Type material – Holotype NHMW 2019/0167/0097, height 5.0 mm, width 1.1 mm; paratype 1 NHMW 2019/0167/0596, height 4.8 mm, width 1.0 mm; paratype 2 NHMW 2019/0167/0597, height 4.9 mm, width 1.0 mm.

Other material – Maximum height 5.0 mm, width 1.1 mm. **VC**: NHMW 2019/0167/0098 (1).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Paolo Crovato of Naples, Italy, friend of the second author, in recognition of his contributions to malacology. *Turbonilla* gender feminine.

Diagnosis – *Turbonilla* species of small size, very slender, subcylindrical profile, type A1 tending to B protoconch, teleoconch of up to nine weakly convex whorls, broad, axial ribs, 12 on penultimate whorl, slightly narrower than their interspaces, columella straight, without fold.

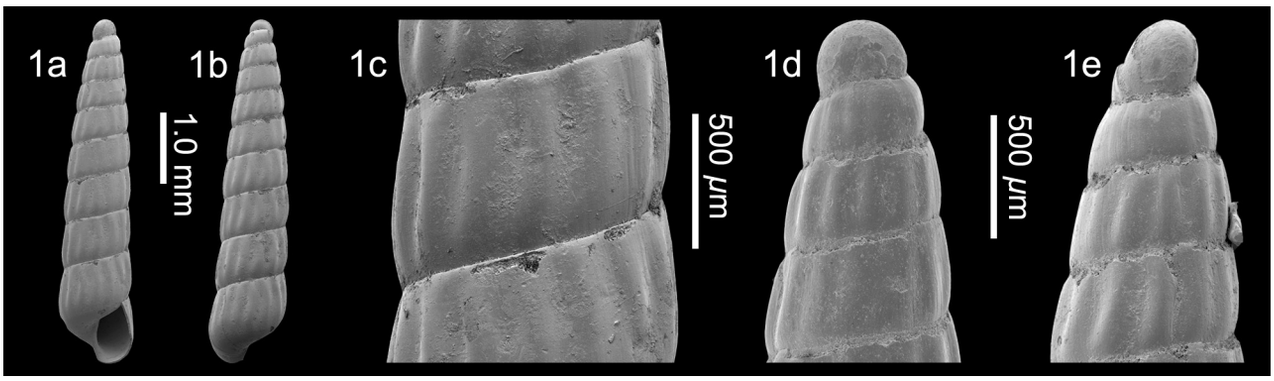

Plate 132. *Turbonilla crovatoi* nov. sp.; 1. **Holotype** NHMW 2019/0167/0097, height 5.0 mm, width 1.1 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Description – Shell small, tall, very slender, subcylindrical. Protoconch type A1 tending to B (dp = 330 μm, hp = 290 μm, tilted at about 125° to main shell axis). Teleoconch of up to nine weakly convex whorls, separated by a moderately impressed, weakly undulating suture. Sculpture of broad, rounded, weakly opisthocline axial ribs, 12 on penultimate whorl, slightly narrower than their interspaces, attenuated at the ad- and abapical suture, no spiral sculpture. Last whorl rounded at periphery, ribs weakening towards periphery, subobsolete over base. Aperture subquadrate, outer lip moderately flared abapically, columella straight, without fold.

Discussion – *Turbonilla crovatoi* nov. sp. seems conspecific with the specimen from the lower Pliocene of Italy illustrated by Brunetti & Cresti (2018, fig. 485) as *Turbonilla dertogracilis* (Sacco, 1892). The holotype of that species illustrated by Ferrero Mortara *et al*. (1984, pl. 12, fig. 14) from the upper Miocene of Italy differs in having a conical as opposed to cyrtoconoid profile, the whorls are less convex and the ribs narrower. Moreover, Sacco (1892a, p. 90) described lirae or denticles within the outer lip and a columellar fold. *Turbonilla micans* (Monterosato, 1875), with which it co-occurs in the Estepona assemblages, differs in having a more pupoid profile, the whorls are higher, especially the early teleoconch whorls, and it has a slightly greater number of axial ribs.

Distribution – Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla dautzenbergi* Glibert, 1949**

Plate 133, figs 1-2

*1949a *Turbonilla* (*Pyrgolampros*) *dautzenbergi* Glibert, p. 192, pl. 11, fig. 6.

Material and dimensions – Maximum height 16.5 mm, width 4.0 mm. **VC**: NHMW 2019/0167/0199-0200 (2), NHMW 2019/0167/0201 (4). **EL**: NHMW 2019/0167/0725 (3).

Discussion – *Turbonilla dautzenbergi* Glibert, 1949 is characterised by its medium to large size for the family, type A1 tending to B protoconch, teleoconch of 7-8 frustate whorls, very slightly pinched just below the suture, separated by a moderately impressed suture. Sculpture consists of 20-25 low, rounded, orthocline axial ribs,

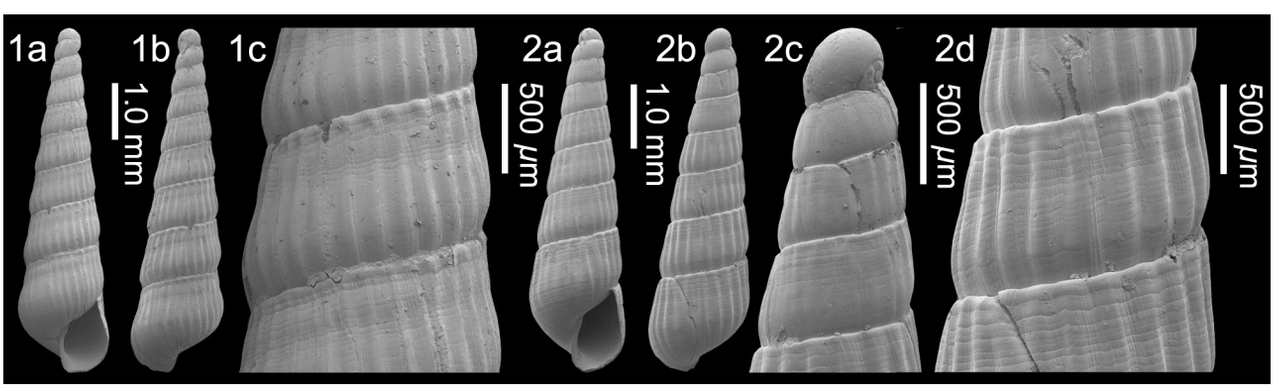

Plate 133. *Turbonilla dautzenbergi* Glibert, 1949; 1. NHMW 2019/0167/0199, height 6.1 mm, width 1.6 mm, 1c, detail of teleoconch sculpture penultimate whorl; 2. NHMW 2019/0167/0200, height 5.4 mm, width 1.5 mm, 2c, detail of protoconch 2d, detail of teleoconch sculpture penultimate whorl (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

roughly equal in width to their interspaces, and fine spiral microsculpture. The last whorl is frustate to strongly so, swollen mid-whorl. The aperture is pyriform, the columella slightly thickened and erect, with a very small fold towards its abapical end.

We note that Glibert (1949a, p. 192) placed the species in the subgenus *Pyrgolampros* Sacco, 1892, but on the plate legend used the subgenus *Strioturbonilla* Sacco, 1892 (1949a, pl. 11, fig 6 legend), probably based on the spiral sculpture that is fine, but clearly visible, and overruns the axial ribs. Glibert (1949b, p. 33) subsequently placed his species in synonymy with *Turbonilla turonensis* Peyrot, 1938. This adds further confusion, as it was based on a specimen from the middle Miocene of the Loire Basin, France (Peyrot, 1938, p. 67, pl. 3, figs 29, 34), that on the plate text is ascribed to *Turbonilla* (*Strioturbonilla*) *miocrassulata* var. *elongata* Peyrot. It may be that Peyrot changed his manuscript name at some stage, but did not emend the text or plate. In any case, we consider this synonymy incorrect, as Peyrot's species has quite a different shell profile, regularly conical-cylidrical, without the markedly inflated abapical portion of the whorls giving them the frustate profile seen in Glibert's species. The Estepona specimens are closely similar to the holotype illustrated by Glibert (1949a, pl. 11, fig. 6), although some have even more strongly frustate whorls (Pl. 133, fig. 1).

This species is similar to *Turbonilla plicatulosenensis* Sacco, 1892 from Italian Pliocene (type material figured by Ferrero Mortara *et al*., 1984, pl. 13, fig. 1), in having fine spiral sculpture overrunning the ribs, but differs in whorl profile, having flat-sided whorls, slightly inflated and angled just above the adapical suture, the ribs are larger and flatter, and the aperture is squared.

Distribution – Middle Miocene: Atlantic, Loire Basin, France (Glibert, 1949a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla* cf. *gracilis* (Brocchi, 1814)**

Plate 134, figs 1-2

cf. *1814	*Turbo gracilis* Brocchi, p. 382, pl. 6, fig. 6.
cf. 1892a	*Turbonilla* (*Pyrgolampros*) *gracilis* (Br.) – Sacco, p. 89, pl. 2, fig. 98.
cf. 1969	*Turbonilla* (*Pyrgolampros*) *gracilis* Brocchi – Fekih, p. 35, pl. 6, fig. 8.
cf. 1976	*Turbonilla* (*Pyrgolampros*) cfr. *gracilis* (Brocchi, 1814) – Pavia, p. 164, pl. 11, fig. 14.
2011	*Turbonilla* cf. *gracilis* (Brocchi, 1814) – Chirli & Micali, p. 79, pl. 28, figs 14-18.
non 1955	*Turbonilla* (*Pyrgolampros*) *gracilis* (Brocchi) 1814 – Rossi Ronchetti, p. 154, fig. 78 [= *T.* (*P.*) *exgracilis* (Sacco, 1892)].
non 1978	*Turbo gracilis* Brocchi, 1814 – Pinna & Spezia, p. 163, pl. 60, fig. 2 [= *T.* (*P.*) *exgracilis* (Sacco, 1892)].

Material and dimensions – Maximum height 14.6 mm, width 3.8 mm. **CO**: NHMW 2019/0167/0215 (4). **VC**: NHMW 2019/0167/0188 (1), NHMW 2019/0167/0189 (3), NHMW 2019/0167/0743 (2). **EL**: NHMW 2019/0167/0217 (1).

Discussion – This species is characterised by its large size, type A1 protoconch of just under 2.5 whorls, with a small nucleus (Estepona specimen: dp = 385 μm, hp = 325 μm, dn = 75 μm, tilted at angle of 110° to main shell axis). Teleoconch composed of up to 11 flat-sided whorls, slightly concave and pinched in the adapical portion, separated by a weakly impressed undulating suture, bearing well-developed, elevated, straight, close-set, rounded, orthocline ribs that extend between the sutures, 20-24 on the penultimate whorl, wider than their interspaces, and very fine crowded spiral sculpture in the axial interspaces. The last whorl is markedly concave adapically, rounded at the base, the ribs fading gradually towards the periphery. The Estepona material matches the A1 type protoconch seen in the Italian specimens.

Pavia (1976, p. 164) pointed out that in the Brocchi collection at the Museo Civico di Storia Naturale, Milan, there are two syntypes of *Turbo gracilis* Brocchi, 1814 from the Pliocene of S. Giusto (Volterra), Italy. One of these was drawn by Sacco (1892a, pl. 2, fig. 98). Taking into account the close similarity with Brocchi's original figure and description, and Sacco's text (1892a, p. 89) stating that his drawing was based on type material, it is reasonable to assume that Sacco's drawing was based on Brocchi's original specimen. This specimen was subsequently broken.

The second syntype, the specimen figured by Rossi Ronchetti (1955, fig. 78), differs in having lower whorls, a deeper suture, and narrower ribs that are more elevated up to last whorl. The 'type' figured by Sacco has a conical-turriculate profile, with narrow spiral grooves that delimit broad ribs in the central portion of the whorl. Pavia (1976) corrected Rossi Ronchetti's description in confirming the presence of teeth inside the outer lip, even if difficult to see due to the broken peristome.

Therefore, only the paratype indicated by Rossi Ronchetti ('type' according to Sacco) represents *T. gracilis*. The type designated by Rossi Ronchetti and some material from Pliocene of Piemonte and Liguria are possibly referred to *T.* (*P.*) *exgracilis* (Sacco, 1892).

Considering the discussion above, we consider that apart from the descriptions by Brocchi and Sacco, the other bibliographic references probably do not refer to *T. gracilis* and we follow Pavia (1976) in leaving this species in open nomenclature until further topotypic material is available.

The specimen figured from the Velerín carretera deposits (Pl. 134, fig. 1) is almost identical to the one figured by Chirli & Micali (2011, pl. 28, figs 14-18) as *Turbonilla* cf. *gracilis* from Italy. This species forms part of the '*Strioturbonilla*' *sensu* Cossmann, 1921 group placed herein in *Turbonilla* (*sensu lato*), for further comparison see under *T. multilirata* (Monterosato, 1875).

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; ?Chirli & Micali, 2011), ?Tunisia

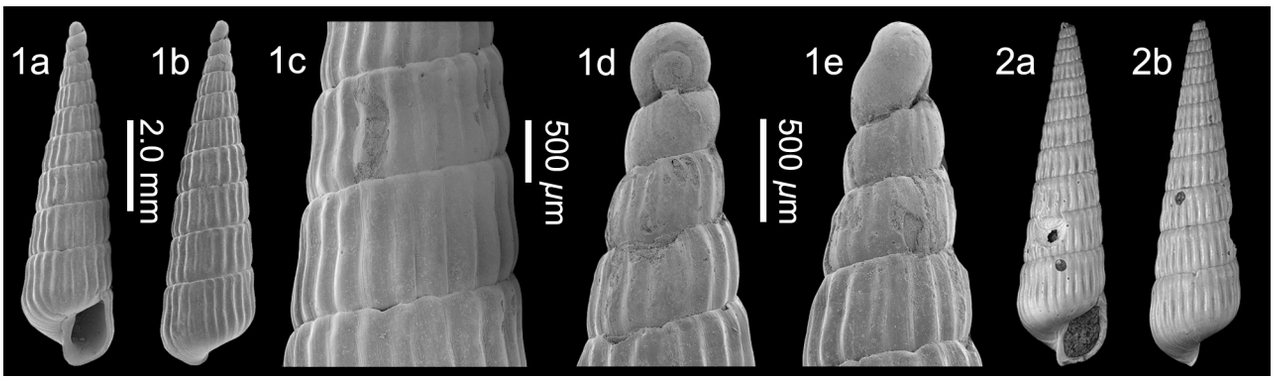

Plate 134. *Turbonilla* cf. *gracilis* (Brocchi, 1814); 1. NHMW 2019/0167/0743, height 7.7 mm, width 2.1 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image); 2. NHMW 2019/0167/0188, height 14.6 mm, width 3.8 mm, (digital image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

(Fekih, 1969). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla haullevillei* Dautzenberg, 1912**
Plate 135, fig. 1

*1912	*Turbonilla haullevillei* Dautzenberg, p. 62, pl. 2, figs 34, 35.
1912	*Turbonilla marteli* Dautzenberg, p. 62, pl. 3, figs 1, 2.
1997	*Turbonilla haullevillei* Dautzenberg, 1913 [*sic*] – Peñas & Rolán, p. 8, figs 6-11.
2014	*Turbonilla haullevillei* Dautzenberg, 1912 – Peñas *et al*., p. 190, figs 28H-I.

non 1994 *Turbonilla marteli* Dautzenberg, 1913 [*sic*] – Schander, pl. 7, fig. F, pl. 15, fig. G (*non* Dautzenberg, 1912) [= *Turbonilla pseudomarteli* Peñas & Rolán, 1997).

Material and dimensions – Maximum height 2.8 mm, width 880 µm. **VC**: NHMW 2019/0167/0487 (1). **VS**: NHMW 2019/0167/0441 (1), NHMW 2019/0167/0442 (1).

Discussion – *Turbonilla haullevillei* Dautzenberg, 1912 is characterised by its conical, moderately elongate profile, type A2 tending to B protoconch, with the nucleus fully exposed (Estepona specimen; dp = 250 µm, hp = 230 µm, tilted at angle of about 117° to main shell axis), teleoconch of up to five whorls, with the periphery placed at one-third whorl height, first two whorls convex, abapically whorls slightly pinched adapically, swollen abapically, separated by a moderately impressed suture, sculpture of 15-16 low, orthocline, rounded ribs, slightly narrower than their interspaces, very fine closeset spiral sculpture covers the entire whorl, last whorl slightly concave abapically, broadly rounded at the periphery, the ribs weakening at the periphery, subobsolete over the base, aperture pyriform, columella slightly oblique, without fold. The Estepona specimens compare well with the recent specimen from Ghana illustrated by Peñas & Rolán (1997, fig. 8) and Peñas *et al.* (2014, figs 28H-I). However, the protoconch diameter is smaller (dp = 347 µm, *fide* Peñas & Rolán, 1997), possibly a little more immersed than that figured by those authors (1997, fig. 9; 2014, figs 28H-I), but fits within intraspecific variability. We also note that the entire teleoconch is covered by extremely fine spiral sculpture visible only under high magnification. This is the first fossil record for this species.

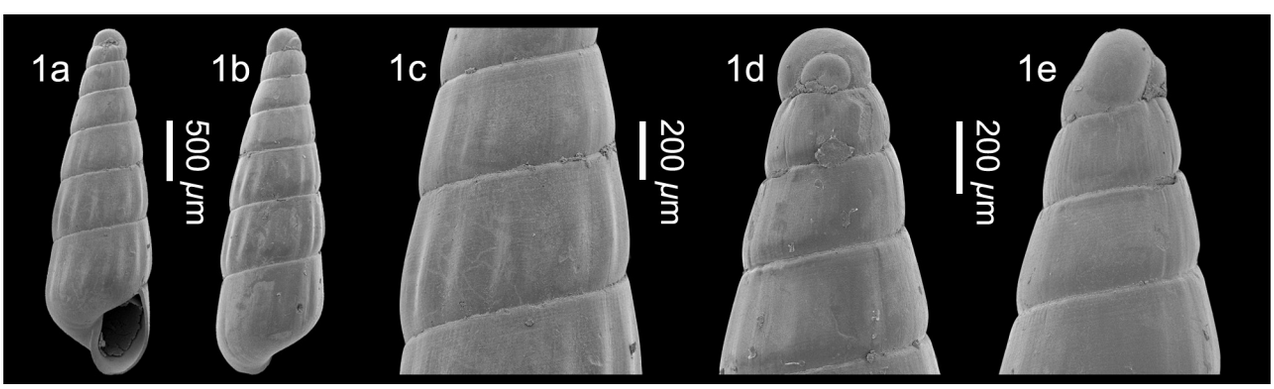

Plate 135. *Turbonilla haullevillei* Dautzenberg, 1912; 1. NHMW 2019/0167/0441, height 2.8 mm, width 880 µm, 1c, detail of sculpture last two teleoconch whorls, 1d-e, detail of protoconch (SEM image). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Distribution –Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: West Africa, Gabon, Congo, Angola (Dautzenberg, 1912; Peñas & Rolán, 1997, 2002; Peñas *et al*., 2014).

***Turbonilla* cf. *ligusticoterebralis* Sacco, 1892**

Plate 136, fig. 1

cf. *1892a	*Turbonilla (Pyrgolampros) ligusticoterebralis* Sacco, p. 89, pl. 2, fig. 96.
cf. 1984	*Pyrgolampros ligusticoterebralis* Sacco, 1892 – Ferrero Mortara *et al*., 1984, p. 83, pl. 13, fig. 8.

Material and dimensions – Maximum height 4.2 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0180 (1), NHMW 2019/0167/0529 (1), NHMW 2019/0167/0282 (1), NHMW 2019/0167/0283 (18), NHMW 2019/0167/0835 (1).

Discussion – The lectotype illustrated by Ferrero Mortara *et al*. (1984, pl. 13, fig. 8) is poorly preserved and lacks its apex and aperture. Therefore this species is open to interpretation. We consider the specimen illustrated herein (Pl. 136, figs 1, 2) from Estepona to represent Sacco's species, however, due to the poor preservation of the type material we leave it in open nomenclature. It is characterised by its small conico-elongate profile, type A1 tending to B protoconch composed of 2.25 whorls,with the nucleus exposed (Estepona specimen; dp = 405-430 μm, hp = 360-380 μm, dn = 120 μm, tilted at about 110-115° to main shell axis), teleoconch of seven or more whorls, straight sided, slightly pinched at two-thirds whorl height, separated by a superficial suture, sculpture of about 18-20 straight, low, orthocline ribs, slightly narrower than their interspecies, the ribs flattening towards to sutures, last whorl straight-sided, strongly convex at periphery, base depressed, the ribs weakening at the periphery, not extending onto the base, the aperture is subquadrate, the columella, short, weakly oblique, and without a fold.

As stated by Sacco (1892a, p. 89), this species resembles *T. pseudoterebralis* Sacco, 1892 and *T. terebraeformis* De Stefani & Pantanelli, 1878. He distinguished it from the former in having prosocline instead of orthocline ribs. We further note that the syntype of *T. pseudoterebralis* figured by Ferrero Mortara *et al*. (1984, pl. 13, fig. 4) clearly shows a sub-pupoid outline, whereas *T. ligusticoterebralis* has a conical profile.

De Stefani & Pantanelli *in* De Stefani (1888) described *Turbonilla terebraeformis* Meneghini, without indicating a date, nor claiming authorship. This species was possibly never described or listed by Meneghini, but given by him to De Stefani, with whom he was in contact. Authorship with the original description and drawing goes to De Stefani & Pantanelli *in* De Stefani (1888, p. 225, pl. 11, fig. 27). It clearly differs from *T. ligusticoterebralis* in having spiral striations present on the whorls (about four grooves) and the base, and the strong spiral cord at the adapical suture. *Turbonilla* cf. *ligusticoterebralis* differs from *T. dautzenbergi* Glibert, 1949 in having flat-sided whorls instead of frustate, the lack of spiral sculpture, and the deeper suture.

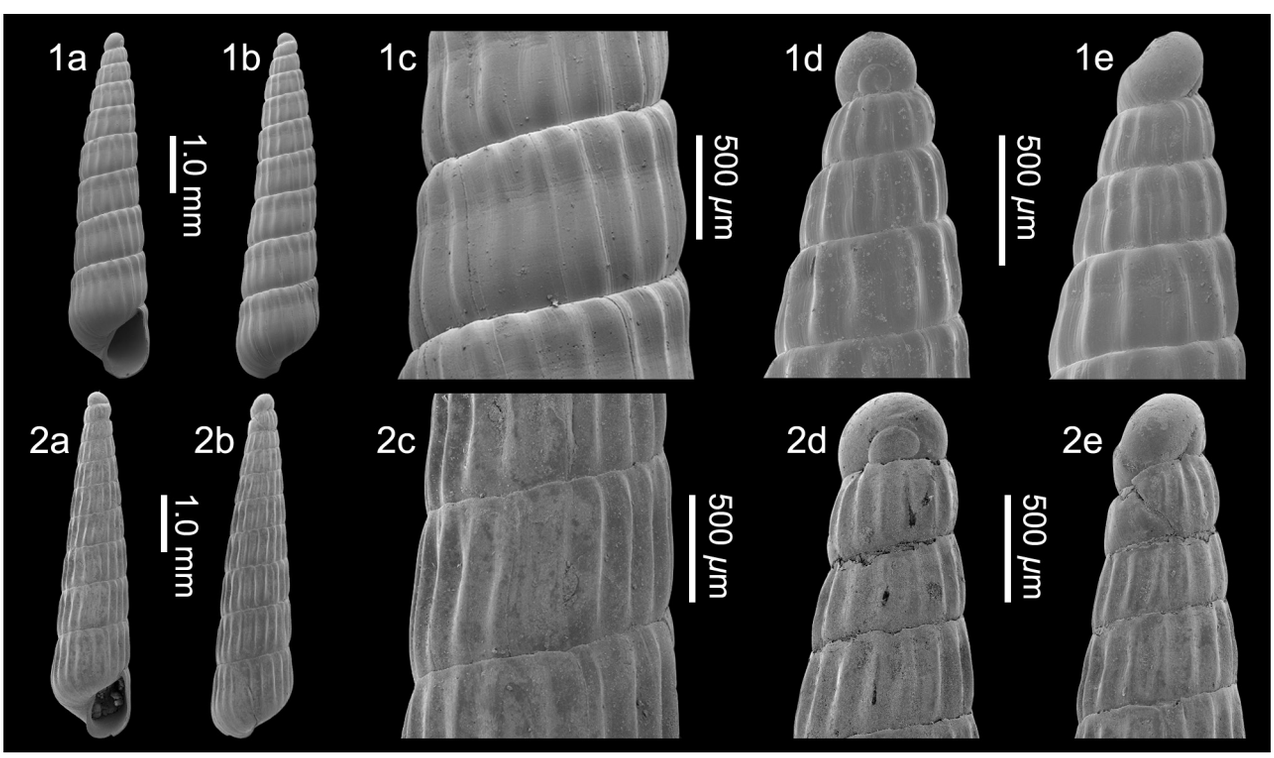

Plate 136. *Turbonilla* cf. *ligusticoterebralis* Sacco, 1892; 1. NHMW 2019/0167/0180, height 6.1 mm, width 1.4 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0529, height 6.1 mm, width 1.4 mm, 2c, detail of teleoconch sculpture penultimate whorl, 2d-e, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Distribution – ?Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992b). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); ?central Mediterranean, Italy (Sacco, 1892a; Ferrero Mortara *et al*., 1984).

***Turbonilla malacitana* nov. sp.**
Plate 137, fig. 1

2008 *Turbonilla pseudoterebralis* (Sacco, 1892) – Chirli, & Richard, p. 78, pl. 15, fig. 10 (*non Turbonilla pseudoterebralis* Sacco, 1892).

Type material – Holotype NHMW 2019/0167/0098, height 4.4 mm, width 1.2 mm, **VQ**. Paratype 1 NHMW 2019/0167/0848, height 4.0 mm, width 1.1 mm, **VC**.

Other material – Known from type series only.

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after the province of Malaga, Spain. *Turbonilla* gender feminine.

Diagnosis – *Turbonilla* species of small size, tall, scalate spire, type A2 protoconch with large nucleus, teleoconch of up to nine strongly shouldered whorls, shoulder placed high, sculpture of narrow, orthocline ribs, 15 on penultimate whorl, 2-3 times narrower than their interspaces, columella straight, without fold.

Description – Shell slender, tall conical, scalate spire. Protoconch type A2, just under two whorls, with large nucleus (dp = 250 μm, hp = 240 μm, dn = 120 μm). Teleoconch of nine strongly shouldered whorls, the shoulder placed close below the suture, separated by moderately impressed undulating suture. Sculpture of narrow, raised, orthocline ribs, 15 on penultimate whorl, separated by interspaces 2-3 times width of ribs. Last whorl 33% total height, strongly shouldered, almost straight-sided below, rounded at base, ribs weakening relatively abruptly at base, but not forming basal disc, base smooth, imperforate. Aperture subquadrate, 18% total height, outer lip rounded, weakly flared abapically, columella short, vertical, without fold.

Discussion – Although represented by few specimens, with its scalate, shouldered whorls *Turbonilla malacitana* nov. sp. is a very characteristic species and warrants formal description. It is similar to *Turbonilla* sp. in Brunetti & Cresti (2018, fig. 499) from the Italian lower Pliocene, which differs in having non-gradate early teleoconch whorls, a more pointed and less gradate outline, whorls abapically contricted and a type A1 protoconch rather than type A2 as seen in *T. malacitana*. The specimen illustrated by Chirli, & Richard (2008, pl. 15, fig. 10) from the Pliocene Roussillon Basin of France as *Turbonilla pseudoterebralis* (Sacco, 1892) seems to be conspecific with the Estepona specimen.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), Roussillon Basin, France (Chirli & Richard, 2008).

***Turbonilla mauroi* nov. sp.**
Plate 138, figs 1-3

Type material – Holotype NHMW 2019/0167/0204, height 4.6 mm, width 1.2 mm; paratype 1 NHMW 2019/0167/0205, height 3.8 mm, width 1.2 mm; paratype 2 NHMW 2019/0167/0580, height 4.2 mm, width 1.2 mm.

Other material – Maximum height 5.0 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0206 (22). **EL**: NHMW 2019/0167/0831 (2).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after Mauro Nieland, grandson of Henk Mulder, in recognition of Henk's help in this monograph. *Turbonilla* gender feminine.

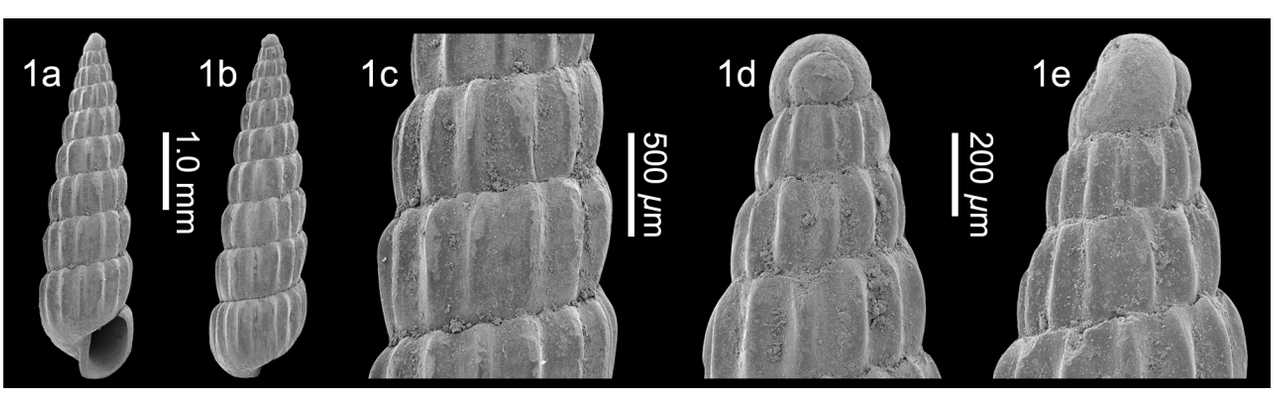

Plate 137. *Turbonilla malacitana* nov. sp.; 1. **Holotype** NHMW 2019/0167/0533, height 4.4 mm, width 1.2 mm, 1c, detail sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín quarry, Velerín, Estepona, lower Piacenzian, upper Pliocene.

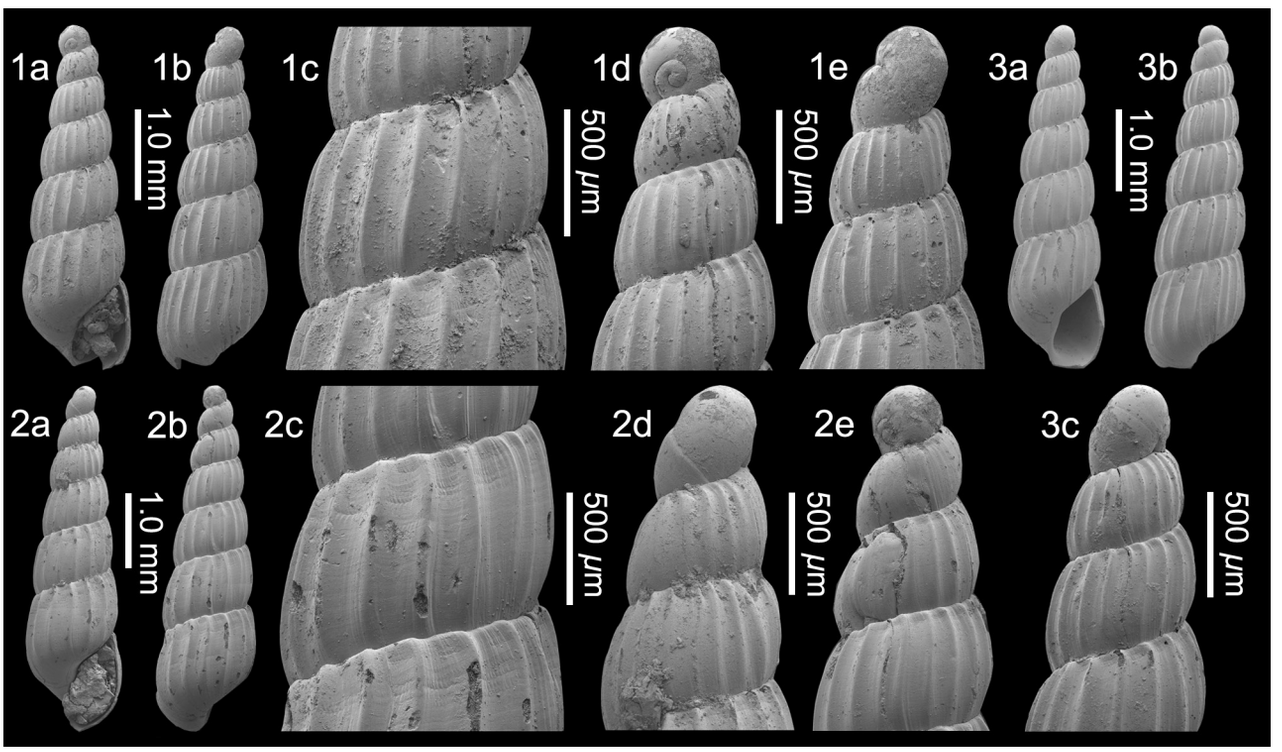

Plate 138. *Turbonilla mauroi* nov. sp.; 1. **Paratype 1** NHMW 2019/0167/0205, height 3.8 mm, width 1.2 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch; 2. **Holotype** NHMW 2019/0167/0204, height 4.6 mm, width 1.2 mm, 2c, detail of teleoconch sculpture penultimate whorl, 2d-e, detail of protoconch; 3. **Paratype 2** NHMW 2019/0167/0580, height 4.2 mm, width 1.2 mm, 3c, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Diagnosis – *Turbonilla* species of small size, moderately elongated conical spire, type A1 tending to B protoconch, teleoconch of five regularly convex whorls, sculpture of 15-17 narrow opisthocline ribs, faint spiral sculpture on abapical half of whorls, last whorl tall, columella oblique, without fold.

Description – Shell small, slender, fragile, moderately elongated conical spire. Protoconch type A1 tending to B protoconch of almost 2.25 whorls, with the nucleus fully exposed (dp = 350 μm, hp = 340 μm, dn = 70 μm, tilted at about 125° to main shell axis). Teleoconch of up to six tall, evenly convex whorls, with periphery midway between mid-whorl and abapical suture, separated by shallow, inclined, weakly undulating suture. Sculpture of very narrow, opisthocline, slightly sinuous axial ribs, 15-17 on penultimate whorl, separated by interspaces 3-4 times the width of the ribs. Extremely faint irregular spiral grooves present on abapical half of whorls (seen only in best preserved specimens). Last whorl tall, 41-45% of total height, rounded at base, axials weakening towards periphery, subobsolete over base. Aperture pyriform, outer lip somewhat flared abapically. Columella oblique, without fold.

Discussion – The shape and sculpture of *Turbonilla mauroi* nov. sp. makes it a very characteristic species, quite unlike any other turbonillid in the Estepona assemblages. It is possible that this is the same species described by Risso (1826) as *T. costulata*, the type species of the genus. Unfortunately, neither the description nor the discussion help to adequately characterise that species, and Arnaud (1978, p. 113) interpreted Risso's species as *Turbonilla lactea* (Linnaeus, 1758). Risso's type is presumed lost (Arnaud, 1978, p. 113) and we consider this a *species inquirenda*.
Turbonilla oliverioi Peñas & Rolán, 1997 from present-day West Africa shows a similar profile with strongly convex whorls, in particular the specimens figured in Peñas & Rolán (2002, figs 69-75), but that species differs in having an A2 type protoconch and the axial ribs stop abruptly at a well-developed basal disc.

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

Turbonilla meneghinii **Libassi, 1859**
Plate 139, figs 1-2

*1859	*Turbonilla Maneghini* [*sic*] Libassi, p. 20, fig. 10.
1892a	*Turbonilla Meneghinii* Lib. – Sacco, p. 76 (*nomen emendatum*).
1904	*Turbonilla Meneghinii* Lib. – Sacco, p. 109, pl. 24, fig. 13.
1989	*Turbonilla meneghini* Libassi, 1859 [*sic*] – Chirli, p. 113, pl. 2, fig. 2.

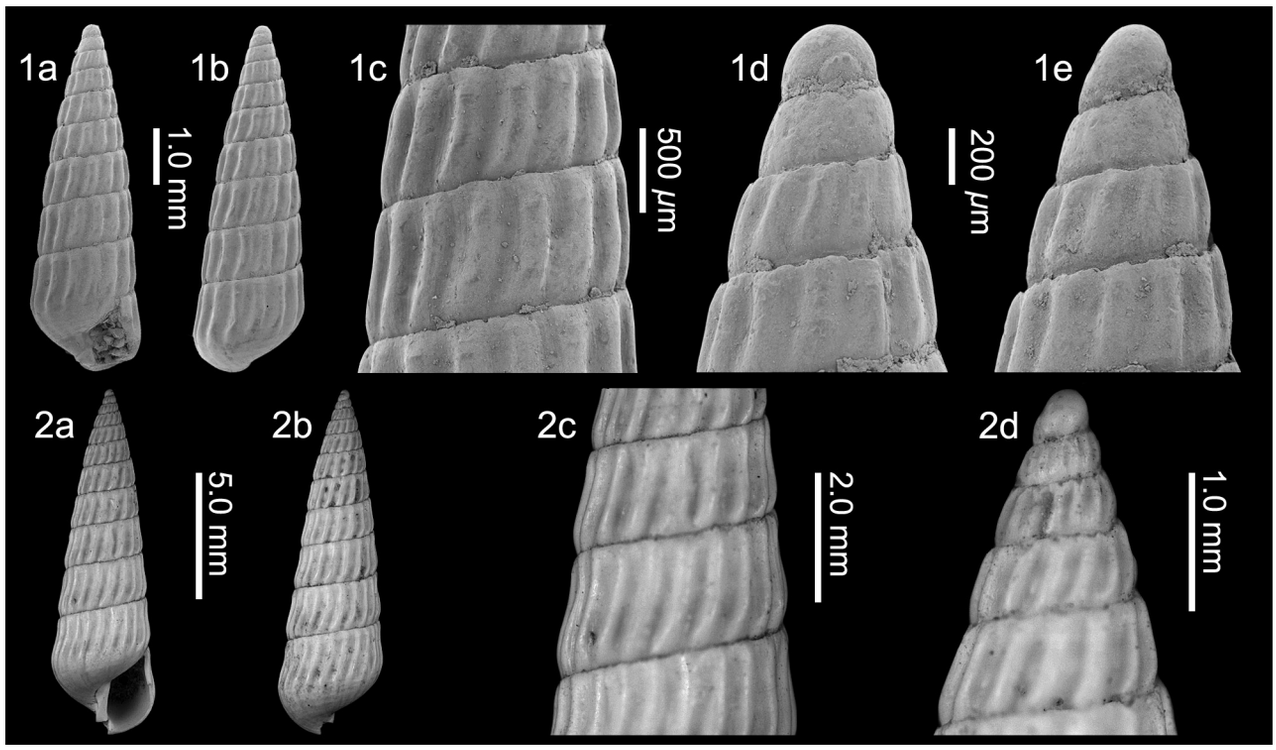

Plate 139. *Turbonilla meneghinii* Libassi, 1859; 1. NHMW 2019/0167/0307, height 6.1 mm, width 1.9 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image); 2. NHMW 2019/0167/0307, height 13.9 mm, width 4.9 mm, 2c, detail of sculpture last two spire whorls, 2d, detail of protoconch (digital image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

2011 *Turbonilla meneghini* Libassi, 1859 [*sic*] – Chirli & Micali, p. 89, pl. 31, figs 12-18.

Material and dimensions – Maximum height 13.9 mm, width 4.9 mm. **CO**: NHMW 2019/0167/0187 (4), NHMW 2019/0167/0186 (5), NHMW 2019/0167/0307 (1), NHMW 2019/0167/0308 (1). **VC**: NHMW 2019/0167/0185 (1), NHMW 2019/0167/0849 (2). **VS**: NHMW 2019/0167/0440 (1).

Discussion – The species was dedicated by Libassi (1859, p. 20) to the Italian botanist, geologist and palaeontologist Giuseppe Giovanni Antonio Meneghini (1811-1889), the trivial name was originally misspelled (*lapsus*) and the correction by Sacco (1892a, p. 76) is justified (ICZN 1999, Art. 32.5.1).
Turbonilla meneghini Libassi, 1859 is characterised by its moderately slender, elongated, solid shell, type A protoconch (Estepona specimen; dp = 346 μm, hp = 300 μm, tilted at about 110° to main shell axis) and teleoconch of up to ten low, very slightly concave whorls, separated by a moderately impressed suture. The teleoconch whorls bear broad, rounded, slightly curved, opisthocline ribs, roughly equal in width to their interspaces, about 15 on the penultimate whorl. Regular, close-set growth lines cover the entire surface (Pl. 139, fig. 1c). The last whorl is slightly concave, rounded at the base; the ribs stop relatively sharply at the periphery, but without forming a well defined basal disc, the columella is short, with a well-developed fold.
The species has seldom been illustrated, but our specimen is closely similar to that from the Italian Pliocene illustrated by Chirli & Micali (2011, pl. 31, figs 12-18). The teleoconch characters are identical; the protoconch is slightly more submerged and possibly slightly more tilted, but these differences probably reflect intraspecific variability.
Turbonilla meneghinii is similar to *Chemnitzia lactea* (Linnaeus, 1758), with which is co-occurs in Estepona (see above), but differs in having the first teleoconch whorl devoid of sculpture, a broader apical angle giving a stouter profile, slightly concave whorls, fine growth lines covering the teleoconch whorls, and the axial ribs do not stop as abruptly at the periphery of the last whorl, which accounts for the placement in the genus *Turbonilla* Risso, 1826 rather than *Chemnitzia* d'Orbigny, 1840.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli, 1989; Chirli & Micali, 2014). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Sacco, 1892a).

Turbonilla micans **(Monterosato, 1875)**
Plate 140, fig. 1

*1875 *Odostomia* (*Turbonilla*) *micans* Monterosato, p. 33.
1884 *Odostomia attenuata* Jeffreys, p. 360, pl. 27, fig. 4.

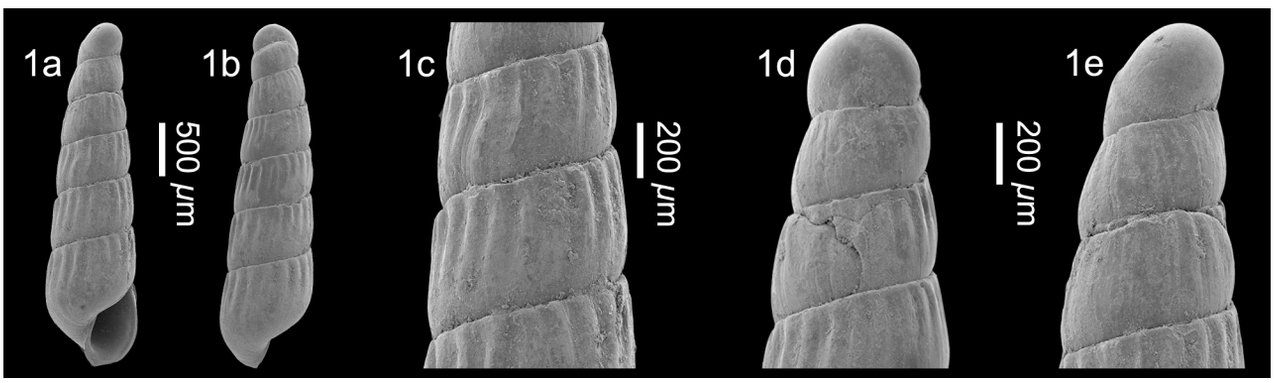

Plate 140. *Turbonilla micans* (Monterosato, 1875); 1. NHMW 2019/0167/0514, height 3.3 mm, width 880 μm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

1972b *Turbonilla* (*Cylindriturbonilla*) *micans* (Monterosato, 1875) – Nordsieck, p. 127, pl. P V, fig. 30.
1992 *Turbonilla micans* (Monterosato, 1875) – Gaglini, p. 163, fig. 150.
1992 *Turbonilla attenuata* (Jeffreys, 1884) – Crovato & Micali, p. 144, pl. 2, figs 3, 4.
1995 *Turbonilla micans* Monterosato, 1875 [*sic*] – Nofroni & Tringali, p. 44, figs 21, 22.
1996 *Turbonilla micans* Monterosato, 1875 [*sic*] – Peñas *et al*., p. 66, figs 172, 178.
2001 *Turbonilla micans* (Monterosato, 1875) – Cachia *et al*., p. 113, pl. 18, fig. 8.
2013 *Turbonilla micans* (Monterosato, 1875) – Öztürk & Bitlis Bakir, p. 431, fig. 19.
2014 *Turbonilla micans* (Monterosato, 1875) – Giannuzzi-Savelli *et al*., p. 80, figs 254-255, appendix p. 30, 77.
2018 *Turbonilla micans* (Monterosato, 1875) – Brunetti & Cresti, p. 112, fig. 487.

Material and dimensions – Maximum height 3.3 mm, width 880 μm. **VC**: NHMW 2019/0167/0514 (1).

Discussion – This species is characterised by its small size, subcylindrical profile, large type B protoconch, just over two whorls, with the nucleus exposed (Estepona specimen; dp = 360 μm, hp = 320 μm, tilted at about 130° to main shell axis), teleoconch of up to six convex whorls, separated by moderately impressed, linear suture, sculpture of weak axial ribs, about 19 on penultimate whorl, that do not reach the abapical suture, last whorl rounded at the smooth base, imperforate, aperture pyriform, and the columella lacks a fold. The Estepona specimen has slightly less convex whorls than recent specimens, and the protoconch is on the upper limit (dp = 310 μm; Peñas *et al*., 1996, fig. 178; dp = 315-320 μm in Mediterranean specimens, PM personal data; dp = 350 μm in Atlantic specimens; Peñas *et al*., 1999, p. 180, figs. 67-71). It is, nevertheless, almost identical to the fossil specimen from Italy figured by Crovato & Micali (1992b, pl. 2, figs 3, 4).
Turbonilla micans may be easily distinguished from *T. pseudomarteli* Peñas & Rolán, 1997 which has a similar profile, in having a type B instead of A2 protoconch, and lacking spiral sculpture.

Distribution – Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992b; as *T. attenuata*; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: western Mediterranean (Nordsieck, 1972b; Peñas *et al*., 1996), central Mediterranean (Nordsieck, 1972b; Gaglini, 1992; Peñas & Rolán, 1997; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

***Turbonilla* cf. *micans* (Monterosato, 1875)**
Plate 141, fig. 1

Material and dimensions – Height 2.4 mm, width 800 μm. **CO**: NHMW 2019/0167/0577 (1).

Description – Shell small, slender, subcylindrical. Protoconch type A1, of just over two whorls (dp = 375 μm, hp = 340 μm, dn = 100 μm, tilted at about 115° to main shell axis). Teleoconch composed of six weakly convex whorls, with periphery at one-third whorl height, separated by linear, weakly impressed, strongly oblique suture. Sculpture of 14-16 very weak, strongly opisthocline axial ribs that further weaken towards, and do not reach, abapical suture. Ribs subobsolete on first and last teleoconch whorls. A few fine, irregular, interrupted, widely spaced spiral grooves present on adapical half of whorls that mostly do not cross the ribs. Last whorl 37% of total height, rounded at periphery, base rounded, imperforate, smooth. Aperture subquadrate, 21% of total height. Outer lip simple (damaged). Columella straight, slightly oblique, without fold.

Discussion – A single specimen from the Velerín conglomerates assemblage is closely similar to *Turbonilla micans* (Monterosato, 1875), and has the same type B protoconch, although slightly larger. However, the whorl

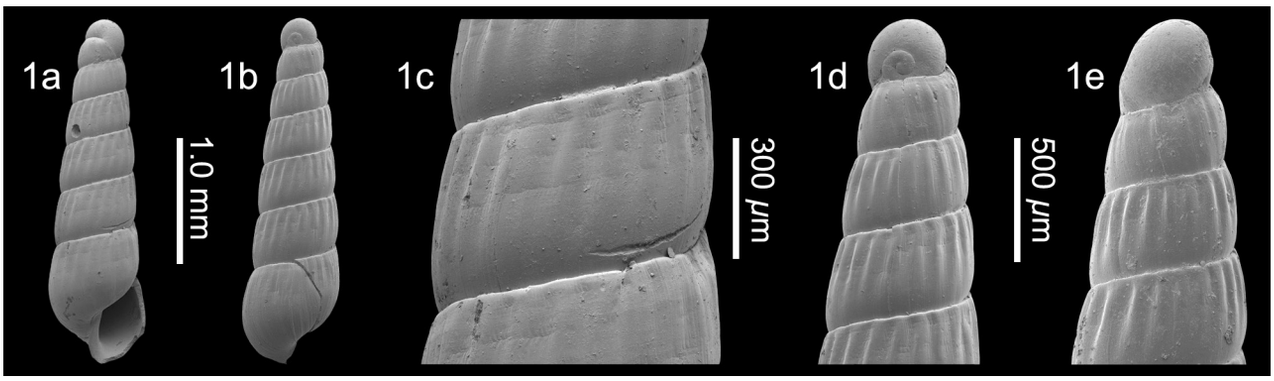

Plate 141. *Turbonilla* cf. *micans* (Monterosato, 1875); 1. NHMW 2019/0167/0577, height 2.4 mm, width 800 µm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

profile in *T. micans* is more straight-sided, the suture more deeply impressed, and it lacks the weak spiral sculpture. It is also closely similar to *T. minima* (Hörnes, 1856), originally described from the middle Miocene Paratethys, and also present in the Italian Pliocene (see Chirli & Micali, 2011, p. 90, pl. 32, figs 1-5), but is immediately separated by its A1 type protoconch, whereas *T. minima* has an A2 type protoconch. Furthemore, the teleoconch whorls in *T.* cf. *micans* are less convex, separated by a less oblique, more superficial suture. *Turbonilla pseudomarteli* (Peñas & Rolán, 1997) from present-day Ghana and Angola is even more similar in whorl profile, but again has an A2 type protoconch, more orthocline ribs, and more regular spiral microsculpture covering the entire whorl, as opposed to just a few irregularly placed spiral grooves seen in this species. *Turbonilla fulgidula* (Jeffreys, 1884) from present-day West Africa is also similar in shape and axial sculpture, but again has an A2 type protoconch, regular fine spiral microsculpture covering the entire whorl.

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

***Turbonilla miovata* Sacco, 1892**
Plate 142, fig. 1

*1892a *Turbonilla* (*Pyrgolampros*) *miovatus* [*sic*] Sacco, p. 91, pl. 2, fig. 104.

Material and dimensions – Maximum height 3.2 mm, width 1.2 mm. **CO**: NHMW 2019/0167/0309 (5). **VC**: NHMW 2019/0167/0082 (1), NHMW 2019/0167/0083 (50+). **EL**: NHMW 2019/0167/0413 (3).

Discussion – *Turbonilla miovata* Sacco, 1892 is characterised by its squat pupoid shell form, small, steeply tilted type B protoconch (Estepona specimen; dp = 210 µm, hp = 190 µm, tilted 140° to main shell axis), teleoconch consisting of 5-6 weakly convex to almost straight sided whorls separated by an impressed, weakly undulating suture, and pyriform aperture, the columella bearing a small fold at its abapical end. Sculpture appears on the second teleoconch whorl, and consists of 15-16 broad orthocline ribs, roughly equal in width to their interpaces that weaken at the periphery, subobsolete over the base. Spiral sculpture is almost absent, with a couple of faint grooves present in the adapical half of the whorl. *Turbonilla miopupoides* Sacco, 1892 is similar in having a

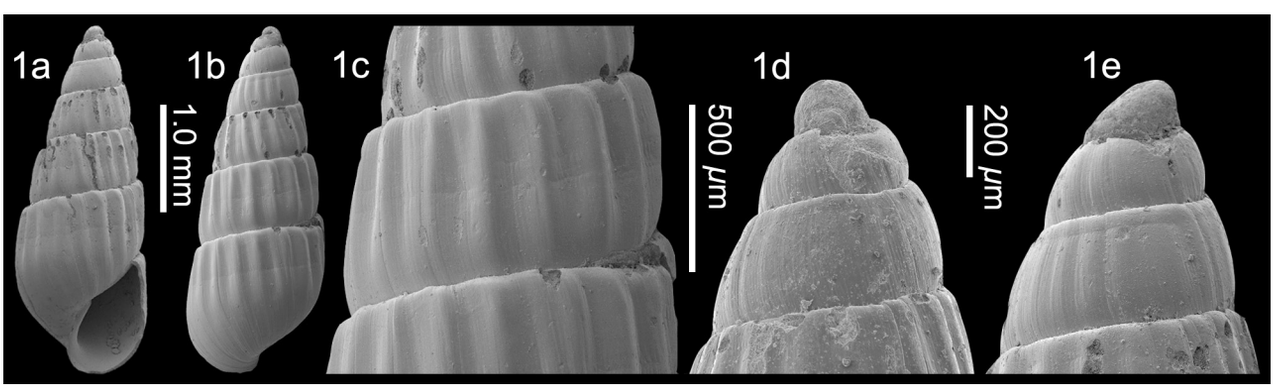

Plate 142. *Turbonilla miovata* Sacco, 1892; 1. NHMW 2019/0167/0082, height 3.2 mm, width 1.2 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

pupoid profile, but has relatively lower spire whorls, and especially the last whorl is much squatter.
This is the first Pliocene record for the species.

Distribution – Upper Miocene (Tortonian): central Mediterranean, Italy (Sacco, 1892a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla multilirata* (Monterosato, 1875)**
Plate 143, fig. 1

*1875	*Odostomia* (*Turbonilla*) *multilirata* Monterosato, p. 33.
1981	*Turbonilla multilirata* (Mtrs.) – Van Aartsen, p. 66, 75, 79.
1992	*Turbonilla multilirata* (Monterosato, 1875) – Gaglini, p. 165, fig. 149.
1996	*Turbonilla multilirata* (Monterosato, 1875) – Peñas *et al*., p. 68, figs 152-153.
2001	*Turbonilla multilirata* (Monterosato, 1875) – Cachia *et al*., p. 113, pl. 18, fig. 9.
2011	*Turbonilla multilirata* (Monterosato, 1875) – Hernández *et al*., p. 267, figs 90S-T.
2014	*Turbonilla multilirata* (Monterosato, 1875) – Giannuzzi-Savelli *et al*., p. 80, fig. 256, appendix p. 30, 78.

Material and dimensions – Maximum height 6.2 mm, width 1.7 mm. **CO**: NHMW 2019/0167/0401 (1), NHMW 2019/0167/0402 (5). **EL**: NHMW 2019/0167/0436 (2).

Discussion – *Turbonilla multilirata* (Monterosato, 1875) is characterised by its conico-subcylindrical, somewhat pupoid profile, type B protoconch of just over two whorls, with the nucleus mostly exposed (Estepona specimen; dp = 310 μm, hp = 280 μm, tilted at about 125° to main shell axis), teleoconch of up to eight whorls, first whorl weakly convex, rapidly becoming straight-sided abapically, separated by a weakly impressed, undulating suture, sculpture of narrow, straight, orthocline ribs, about 16 on penultimate whorl, separated by interspaces twice the width of the ribs, fine spiral sculpture covers entire whorl surface (Pl. 143, fig. 1d), last whorl straight sided, rounded at periphery and base, the ribs and spiral threads persisting over the base, imperforate, aperture pyriform, outer lip markedly flared abapically, and the columella slightly thickened, oblique, without fold. The Estepona specimen is typical for the species, although the protoconch is larger than that of extant specimens (dp = 220-230 μm; *fide* Giannuzzi-Savelli *et al*., appendix p. 78). This is the first fossil record for the species.
This species forms part of the '*Strioturbonilla*' *sensu* Cossmann, 1921 group, having well-developed axial ribs and crowded spiral sculpture that overruns the ribs. It differs from *T. gracilis* (Brocchi, 1814) in being smaller and having fewer, finer and wider-spaced ribs.
Turbonilla (*Strioturbonilla*) *alpina* Sacco, 1892 is a poorly known species, the holotype based on the last three teleoconch whorls illustrated in Ferrero Mortara (1984, pl. 13, fig. 9). This species was based on Pliocene material, but Sacco described four Miocene varieties, that, based on the drawings, all seem rather different to the type. The specimen in Ferrero Mortara clearly differs from *T. multilirata* in having arcuate ribs stopping abruptly at periphery of the last whorl.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Scilly Islands (Nordsieck, 1972b), Canary Islands (Hernández *et al*., 2011), western and central Mediterranean (Nordsieck, 1972b; Peñas *et al*., 1996; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

***Turbonilla pauperata* Locard, 1897**
Plate 144, fig. 1

*1897	*Turbonilla pauperata* Locard, p. 437, pl. 19, figs 14, 15.
1972b	*Turbonilla* (*Magniturbonilla*) *pauperata* Locard, 1897 – Nordsieck, p. 129, pl. P VI, fig. 3a.
1997	*Turbonilla pauperata* Locard, 1897 – Peñas & Rolán, p. 5, fig. 48.

Material and dimensions – Maximum height 10.2 mm,

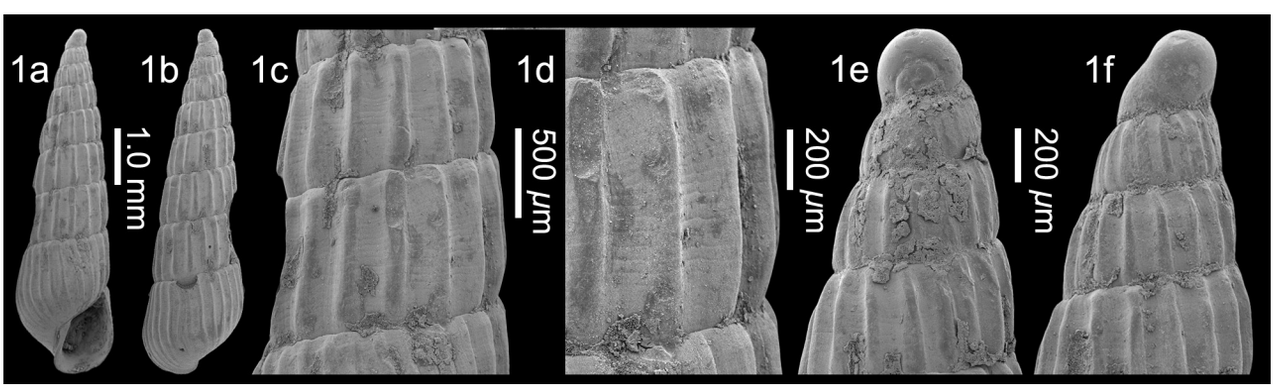

Plate 143. *Turbonilla multilirata* (Monterosato, 1875); 1. NHMW 2019/0167/0401, height 6.2 mm, width 1.7 mm, 1c, detail of sculpture last two spire whorls, 1d, detail showing fine spiral sculpture, 1e-f, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

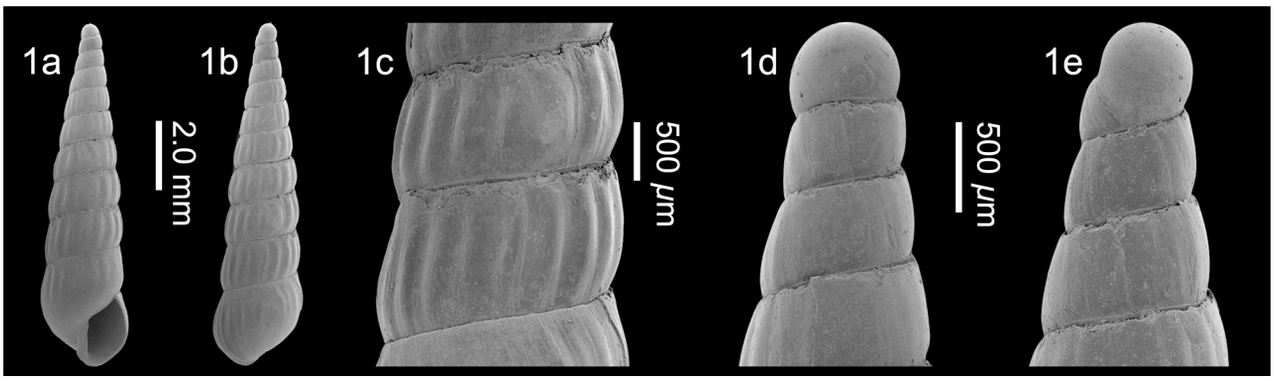

Plate 144. *Turbonilla pauperata* Locard, 1897; 1. NHMW 2019/0167/0121, height 10.2 mm, width 2.6 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

width 2.6 mm. **CO**: NHMW 2019/0167/0086 (2). **VC**: NHMW 2019/0167/0121 (1), NHMW 2019/0167/0202 (17).

Discussion – *Turbonilla pauperata* Locard, 1897 has a very distinctive shell, quite different from any other Estepona turbonillid. The shell is large, elongated, the early whorls have a coeleconoid profile. The protoconch is of type A1 (Estepona specimen; dp = 618 μm, hp = 530 μm, tilted at about 110° to main shell axis). The teleoconch is composed of 9-10 whorls, strongly convex early whorls, and straight-sided late whorls. The first 3-5 whorls are smooth, later whorls bear about 16-18 weak orthocline to slightly opisthocline slightly arched ribs that do not reach the sutures. The last whorl is straight-sided below the suture, weakly anguled base. The axial ribs weaken again on the second half of the last whorl. There is a suggestion of faint spiral microsculpture. Nordieck (1972b, p. 128) erected the subgenus *Magniturbonilla* (type species, by original designation, *Turbonilla speciosa* A. Adams, 1864, present-day, Atlantic NW Spain), and included *T. magnifica* Seguenza, 1880 and *T. pauperata* originally described from the Gulf of Gascony. Justification for this new genus was purely the large size of these species (Nordsieck, 1972a, p. 129), a character we consider insufficient for the justification of a separate genus. *Turbonilla speciosa* differs in reaching a much larger size (24 mm; *fide* Nordsieck, 1972b), having far more numerous axial ribs, and a more depressed base. *Turbonilla magnifica* differs in having stronger axials that are present from the first teleoconch whorl, spiral striation and flat to concave whorls. Both species have a wider apical angle than *T. pauperata*.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Gulf of Gascony to Sahara (Nordsieck, 1972b; Locard, 1897; Peñas & Rolán, 1997).

***Turbonilla* cf. *perplicatotorquata* Sacco, 1892**

Plate 145, figs 1-2

cf. *1892a *Turbonilla* (*Pyrgolampros*) *perplicatotorquata* Sacco, p. 88, pl. 2, fig. 93.

Material and dimensions – Maximum height 4.8 mm, width 1.5 mm. **VC**: NHMW 2019/0167/0207 (1), NHMW 2019/0167/0208 (8), NHMW 2019/0167/0486 (1).

Discussion – *Turbonilla* cf. *perplicatotorquata* Sacco, 1892 is characterised by its short conical profile with a rela-

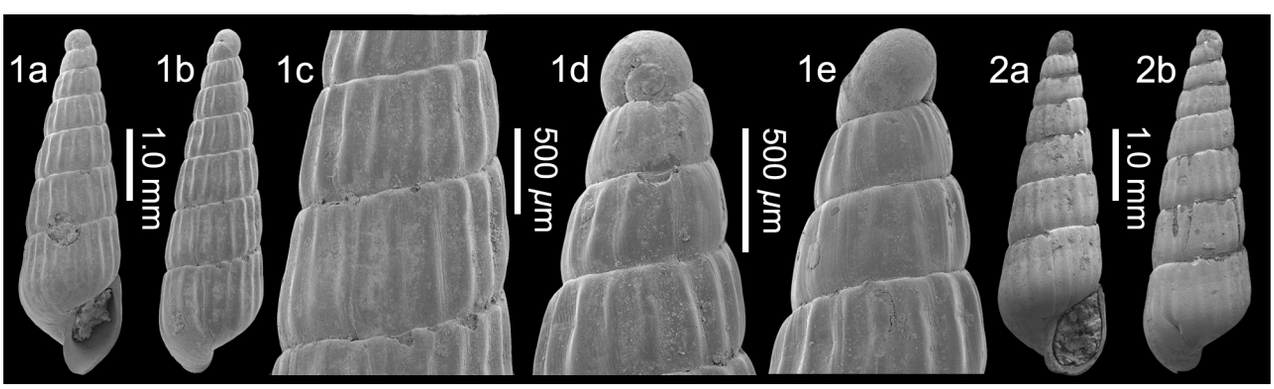

Plate 145. *Turbonilla* cf. *perplicatotorquata* Sacco, 1892; 1. NHMW 2019/0167/0207, height 4.5 mm, width 1.5 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0486, height 4.8 mm, width 1.5 mm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

tively wide apical angle, type B protoconch, of just over two whorls, with the nucleus completely exposed (Estepona specimen; dp = 380 μm, hp = 335 μm), teleoconch consisting of six almost straight-sided whorls separated by a moderately impressed, irregular suture, and pyriform aperture, the columella bearing a small fold at its abapical end. The later whorls are slightly pinched in the adapical half. Sculpture consists of 16-18 low, orthocline to weakly prosocline ribs, narrower than their interpaces that weaken at the periphery, subobsolete over the base. Spiral sculpture is very faint and irregular, with a couple of faint grooves most evident in the pinched adapical portion. *Turbonilla perplicatotorquata* is known only from its original illustration a much larger shell (20 mm height) from the upper Miocene, Tortonian of Italy. Therefore this identification is to be confirmed and the species is left in open taxonomy. *Turbonilla* cf. *perplicatotorquata* differs from *T. plicatulosenensis* Sacco, 1892 in having slightly frustate whorls, lack of subsutural angle and irregular spiral sculpture.

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

***Turbonilla plicatula* (Brocchi, 1814)**
Plate 146, fig. 1

*1814	*Turbo plicatulus* Brocchi, p. 376, pl. 7, fig. 5.
1955	*Turbonilla* (?) *plicatula* (Brocchi, 1814) – Rossi Ronchetti, p. 154.
non 1856	*Turbonilla plicatula* Brocc. – Hörnes, p. 503, pl. 43, fig. 33 [= *Pyrgolampros pseudoterebralis* (Sacco, 1892)].
?*non* 1872	*Chemnitzia plicatula*? Brocchi – Wood, p. 61, pl. 7, fig. 3 [= *Pyrgolampros*? *angloplicatulus* (Sacco, 1892)].
non 1882	*Turbonilla plicatula* Br. – Von Koenen, p. 256, pl. 6, fig. 6 [= *Pyrgolampros teutonoplicatulus* (Sacco, 1892)].
non 2004	*Turbonilla plicatula* (Brocchi, 1814) – Repetto & Lacroce, p. 200, pl. 1, fig. 13a, b [?= *Turbonilla amoena* (Monterosato, 1878)].
non 2018	*Turbonilla plicatula* (Brocchi, 1814) – Brunetti & Cresti, p. 112, fig. 490 [?= *Pyrgolampros undulatus* (Von Koenen, 1882)].

Material and dimensions – Maximum height 10.8 mm, width 3.0 mm. **VC**: NHMW 2019/0167/0524 (1).

Discussion – Unfortunately, the type of *Turbo plicatulus* Brocchi, 1814 from the upper Pliocene of San Giusto, Volterra, Italy is lost (Rossi Ronchetti, 1955, p. 154) and there have been few attempts to interpret the species following its original description. The fragment of shell illustrated by Wood (1872, pl. 7, fig. 3) from the upper Pliocene Red Crag of England was not considered conspecific by Sacco (1892a, p. 86) and renamed *angloplicatula* Sacco, 1892, and similarly the specimen figured by Von Koenen (1882, pl. 6, fig. 6) from the North Sea Miocene of Germany was renamed *Turbonilla teutonoplicatula* Sacco, 1892, although subsequent authors have identified the German species as *Turbonilla* (*Pyrgolampros*) *pseudoterebralis* Sacco, 1892 (Sorgenfrei, 1958, p. 329; Anderson, 1964, p. 326; Wienrich, 2007, p. 764). Having said this, the specimens from Estepona share the same shape and sculpture as Brocchi's original drawing, the height vs. number of whorls fits with original drawing (based on a specimen about 27 mm high), and are provisionally ascribed to that species. Unfortunately, the specimens are incomplete and we cannot augment with a description of the protoconch. The specimen illustrated by Brunetti & Cresti (2018, fig. 490), in our opinion, do not represent Brocchi's species.

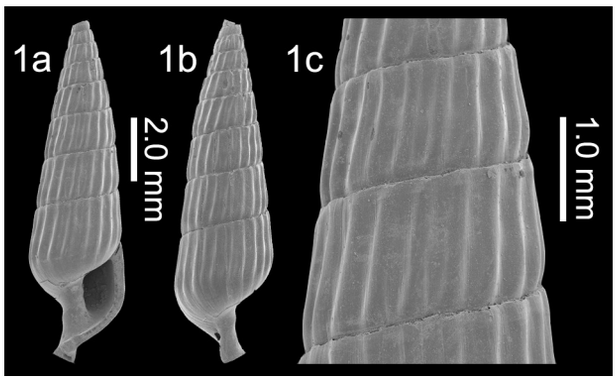

Plate 146. *Turbonilla plicatula* (Brocchi, 1814); 1. NHMW 2019/0167/0524, height 10.8 mm, width 3.0 mm, 1c, detail of sculpture last two spire whorls (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Brocchi, 1814).

***Turbonilla plioalboranensis* nov. sp.**
Plate 147, fig. 1

Type material – Holotype NHMW 2019/0167/0527, height 4.5 mm, width 1.7 mm.

Other material – Known from holotype only.

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Compound name, after the Alboran Sea and the Pliocene epoch. *Turbonilla* gender feminine.

Diagnosis – *Turbonilla* species of small size, broadly conical, large type B protoconch, strongly convex teleoconch whorls with 18 low rounded ribs not extending onto base, no spiral sculpture, aperture ovate, no columellar fold.

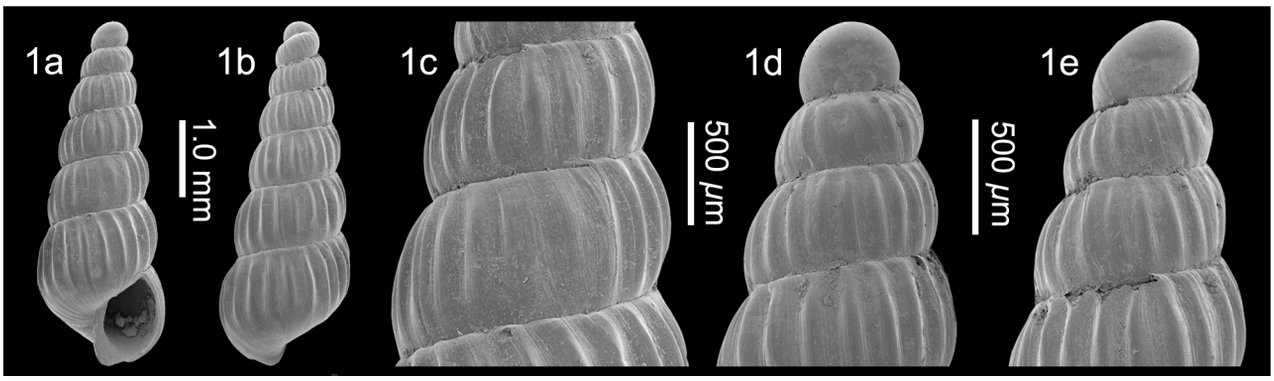

Plate 147. *Turbonilla plioalboranensis* nov. sp.; 1. **Holotype** NHMW 2019/0167/0527, height 4.5 mm, width 1.7 mm, 1c, detail sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Description – Shell small, broadly conical, moderately elongate spire. Protoconch large, type B, two whorls, with nucleus almost completely exposed (dp = 450 μm, hp = 390 μm, dn = 100 μm, tilted at about 135° to main shell axis). Teleoconch of five regularly and strongly convex whorls, with periphery below mid-whorl, separated by weakly oblique, impressed, linear suture. Sculpture of low rounded ribs that do not reach the sutures, 18 on penultimate whorl, about half width of their interspaces, numerous crowded axial growth lines. Last whorl 45% total height, regularly convex, ribs weakening at periphery, subobsolete over base, imperforate. Aperture ovate, 25% total height, outer lip rounded, flared abapically, columella short, thickened, vertical, without fold.

Discussion – This unusual species is placed in the genus *Turbonilla* Risso, 1826 rather than *Chemnitzia* d'Orbigny, 1840 due to the ribs extending albeit subobsoletely over the base and not ending abruptly at the periphery. Only two species similar in profile and sculpture are known for their original description and drawing: *Turbonilla scalariformis* Seguenza, 1880 from the lower Pleistocene of Reggio Calabria, Italy and *T. nucleata* Seguenza, 1880 from the upper Miocene of Benestare, Italy. However the collection of Giuseppe Seguenza was destroyed by the earthquake of Messina in 1908 and these two species were not found by Bertolaso & Palazzi (2000) in the material preserved at the Museo di Geologia e Paleontologia dell'Università di Firenze. Judging from the original figures, *T. scalariformis* is larger, with more numerous whorls that are less convex, whilst in *T. nucleata* the protoconch is relatively larger and less tilted, so that the entire first whorl is exposed. However, it is almost impossible to adequately characterise them based on the illustrations and we therefore consider them *species inquirenda*.

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

Turbonilla pliocolligens **Sacco, 1892**
Plate 148, fig. 1

*1892a *Turbonilla* (*Pyrgolampros*) *pliocolligens* Sacco, p. 88, pl. 2, fig. 95.

Material and dimensions – Maximum height 9.2 mm, width 2.2 mm. **VC**: 2019/0167/0511 (1), NHMW 2019/0167/0512 (3).

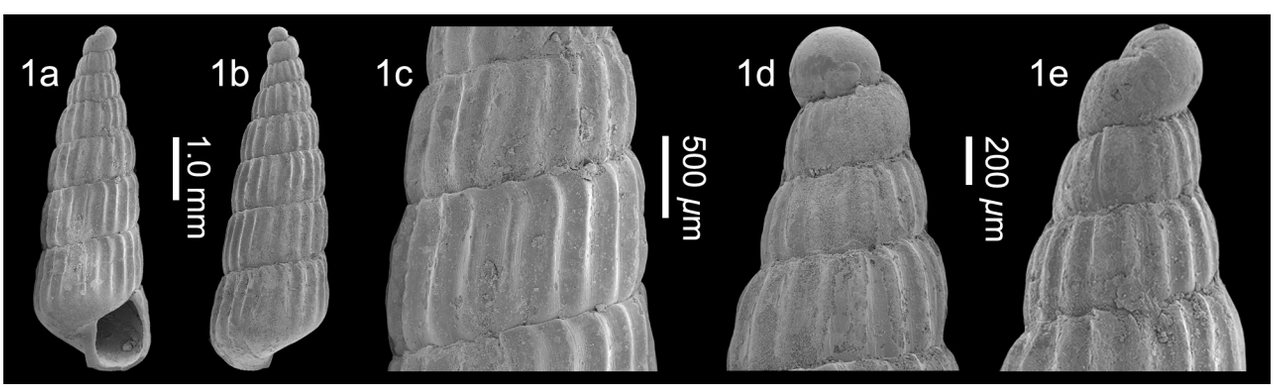

Plate 148. *Turbonilla pliocolligens* Sacco, 1892; 1. NHMW 2019/0167/0511, height 5.4 mm, width 1.9 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Turbonilla pliocolligens* Sacco, 1892 is characterised by its moderately tall, slender, conical profile, large type B protoconch, composed of 2.25 whorls, with the nucleus exposed (Estepona specimen; dp = 380 μm, dn = 95 μm, tilted at about 135° to main shell axis), teleoconch of about seven whorls, first three whorls convex, abapically becoming less convex, separated by a narrowly impressed, finely undulating suture, sculpture of narrow, straight, orthocline to slightly opisthocline ribs, 19-20 on penultimate whorl, about half the width of their interspaces. The last whorl is weakly convex, with rounded periphery, rounded and slightly depressed at the base, imperforate, aperture subquadrate, and the columella is short, oblique, without a fold. The axial ribs stop relatively abruptly at the base in this species, but no basal disc is developed as in the genus *Chemnitzia* d'Orbigny, 1840. Therefore it is placed in *Turbonilla* Risso, 1826. As far as we are aware, this is the first reference to this species since its original publication. *Turbonilla* cf. *perplicatotorquata* Sacco, 1892 (see above) differs in having a more conical outline and the ribs less acute and not adapically curved.

Distribution – Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla pliocostellatoides* Sacco, 1892**
Plate 149, fig. 1

*1892a	*Turbonilla pliocostellatoides* Sacco, p. 77, pl. 2, fig. 64.
1976	*Turbonilla* (*Strioturbonilla*) *pliocostellatoides* (Sacco, 1892) – Pavia, p. 165, pl. 12, figs 1, 4, 5.
1984	*Turbonilla pliocostellatoides* Sacco, 1892 – Ferrero Mortara *et al*., p. 81, pl. 12, fig. 3.
1992	*Turbonilla pliocostellatoides* Sacco, 1892 – Cavallo & Repetto, p. 162, fig. 463.
2010	*Turbonilla pliocostellatoides* **(**Sacco, 1892) [*sic*] – Sosso & Dell'Angelo, p. 53, 67 bottom row right.
2011	*Turbonilla pliocostellatoides* Sacco, 1892 – Chirli & Micali, p. 91, pl. 33, figs 1-6.
2013	*Turbonilla pliocostellatoides* Sacco, 1892 – Bellagamba *et al*., p. 122, fig. 2P-S.
2016	*Turbonilla pliocostellatoides* Sacco, 1892 – Bellagamba & Micali, p. 143, figs 4H-1.

Material and dimensions – Maximum height 4.8 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0275 (1). **EL**: NHMW 2019/0167/0116 (1), NHMW 2019/0167/0117 (4).

Discussion – *Turbonilla pliocostellatoides* Sacco, 1892 is characterised by its slender shell composed of 7-8 weakly convex and scalate whorls, separated by a deeply impressed linear suture. The protoconch is of type A2, of 2.25 whorls (Estepona specimen; dp = 270 μm, dn = 60 μm). Sculpture consists of 14-16 orthocline to slightly opisthocline rounded ribs (20-22 ribs numbered in Chirli & Micali, 2011, p. 92 is an upper limit and not representative of the species; PM personal observation), about half to one-third the width of their interspaces that weaken at the periphery of the last whorl and do not reach the base. Extremely fine, crowded spirals that overrun the ribs and not just present in the axial interspaces as suggested by Chirli & Micali (2011, p. 92). *Turbonilla nofronii* Peñas & Rolán, 1997 from present-day Atlantic coast of Morocco is extremely similar and differs in its smaller dimensions, the whorls are not scalate, and the ribs are more numerous, wider than their interspaces and more strongly opisthocline.

Distribution – Lower Pliocene: central Mediterranean, Italy (Pavia, 1976; Guioli *et al*., 2009). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Sosso & Dell'Angelo, 2010; Bellagamba *et al*., 2013; Bellagamba & Micali, 2016).

***Turbonilla pliopupoides* Sacco, 1892**
Plate 150, fig. 1

*1892a	*Turbonilla* (*Pyrgolampros*?) *pliopupoides* Sacco, p. 92, pl. 2, fig. 106.
1976	*Turbonilla* (*Pyrgolampros*?) *pliopupoides* (Sacco, 1892)[*sic*] – Pavia, p. 165, pl. 11, figs 9-10.

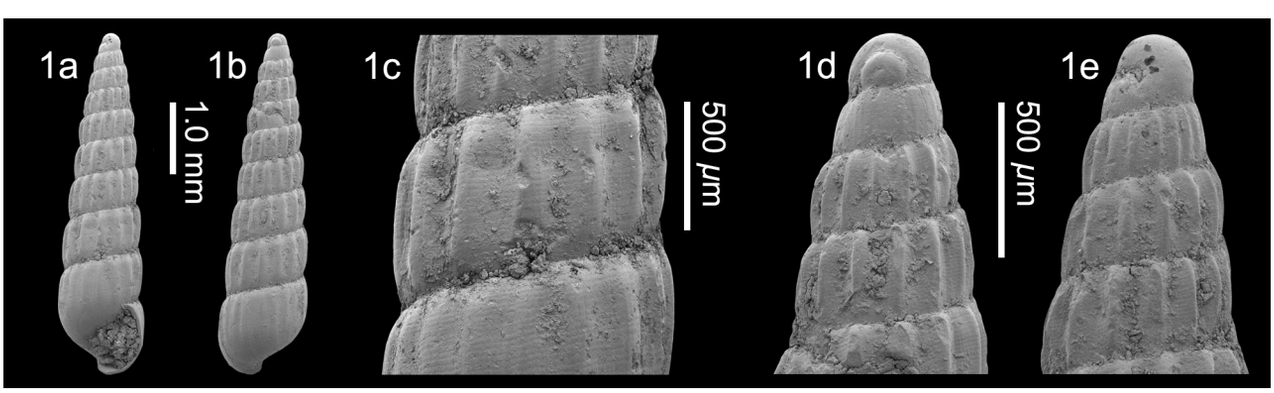

Plate 149. *Turbonilla pliocostellatoides* Sacco, 1892; 1. NHMW 2019/0167/0116, height 4.8 mm, width 1.2 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

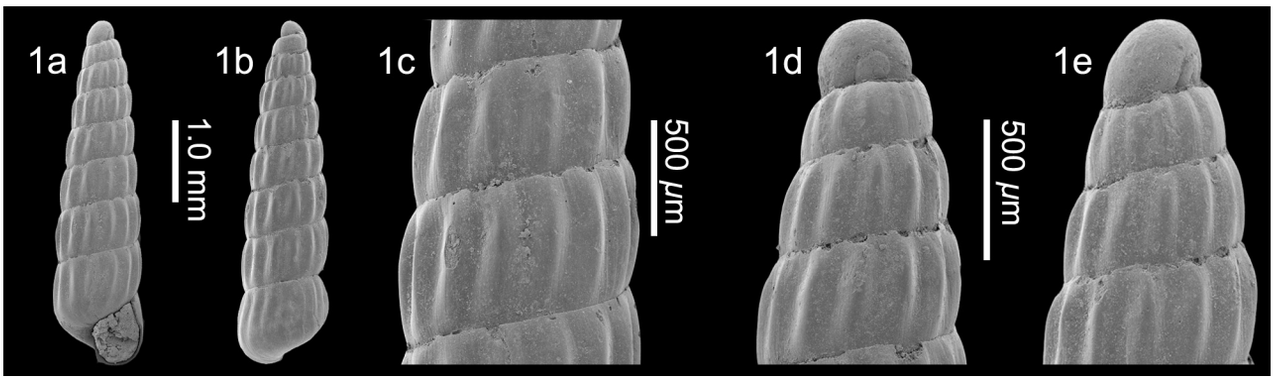

Plate 150. *Turbonilla pliopupoides* Sacco, 1892; 1. NHMW 2019/0167/0284, height 4.2 mm, width 1.1 mm, 1c, detail of sculpture last two spire whorls 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

1984 *Pyrgolampros*? *pliopupoides* Sacco, 1892 – Ferrero Mortara *et al*., p. 84, pl. 12, fig. 8.
1992 *Turbonilla pliopupoides* (Sacco, 1892) [*sic*] – Cavallo & Repetto, p. 162, fig. 165.
2011 *Turbonilla pliopupoides* Sacco, 1892 – Chirli & Micali, p. 94, pl. 34, figs 1-6.
2013 *Turbonilla pliopupoides* (Sacco, 1892) [*sic*] – Landau *et al*., p. 317, pl. 76, fig. 1.
2013 *Turbonilla pliopupoides* (Sacco, 1892) [*sic*] – Bellagamba *et al*., p. 123, fig. 2T-U.
2016 *Turbonilla pliopupoides* (Sacco, 1892) [*sic*] – Bellagamba & Micali, p. 144, figs 4J-K.
2018 *Turbonilla pliopupoides* Sacco, 1892 – Brunetti & Cresti, p. 112, fig. 491.

Material and dimensions – Maximum height 6.1 mm, width 1.4 mm. **VC**: NHMW 2019/0167/0181 (11), NHMW 2019/0167/0284 (1), NHMW 2019/0167/0285 (4). **VS**: NHMW 2019/0167/0857 (2).

Discussion – *Turbonilla pliopupoides* Sacco, 1892 is characterised by its subcylindrical profile, slightly scalate spire, type B protoconch, just over two whorls, with the nucleus completely exposed (Estepona specimen; dp = 325-350 μm, hp = 270-290 μm, dn = 60 μm, tilted 125° to main shell axis), teleoconch of up to eight whorls, slightly pinched at about two-thirds whorl height, where a spiral groove runs in the interspaces, separated by a weakly impressed, undulating suture, sculpture of 14-15 low, rounded, slightly opisthocline ribs, narrower than their interspaces, which bear fine growth lines, last whorl almost straight-sided, rounded at periphery, base convex, the ribs weakening at the periphery, not extending onto the base, the aperture is subquadrate, the columella, short, vertical, and with a well-developed fold.
Turbonilla amoena Monterosato, 1878, which also occurs in the Estepona assemblages, differs in having a conical as opposed to subcylindrical profile, the faster growing in height of the whorls and a taller last whorl, in having more ribs, and lacking the very faint spiral grooves.

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene (Tortonian): central Mediterranean, Italy (Pavia, 1976; Guioli *et al*., 2009; Chirli & Micali, 2011; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper), central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992; Bellagamba *et al*., 2013; Bellagamba & Micali, 2016).

Turbonilla pseudomarteli **Peñas & Rolán, 1997**
Plate 151, fig. 1

1994 *Turbonilla marteli* Dautzenberg 1913 [*sic*] – Schander, p. 51, pl. 7, fig. F, pl. 15, fig. G. (*non* Dautzenberg, 1912 = *Turbonilla haullevillei* Dautzenberg, 1912).
*1997 *Turbonilla pseudomarteli* Peñas & Rolán, p. 38, figs 73-77.

Material and dimensions – Height 3.9 mm, width 935 μm. CO: **PA**: NHMW 2019/0167/0721 (1).

Discussion – *Turbonilla pseudomarteli* Peñas & Rolán, 1997 is characterised by its small, slender, solid, subcylindrical shell, type A1 protoconch, of 2.75 whorls (Estepona specimen; dp = 280 μm, hp = 240 μm, tilted 98° to main shell axis), teleoconch of up to eight weakly convex whorls, separated by a moderately impressed suture, sculpture of low, rounded, orthocline to weakly opisthocline ribs, roughly equal in width to their interspaces, 16 on penultimate whorl that weaken on the penultimate and last whorls and do not extend over the base. Peñas & Rolán, 1997 (1997, fig. 77) showed the species to have the teleoconch whorls covered in fine pitted microsculpture. The Estepona specimen is somewhat abraded, but remants of this fine sculpture are preserved just below the suture (Pl. 151, fig. 1d). The aperture is subquadrate, the columella, short, vertical, without a fold.
Turbonilla pseudomarteli differs from *T. marteli* Dautzenberg 1912 in having a type A1 protoconch instead of B, the shell is slenderer subcylindrican and not subconi-

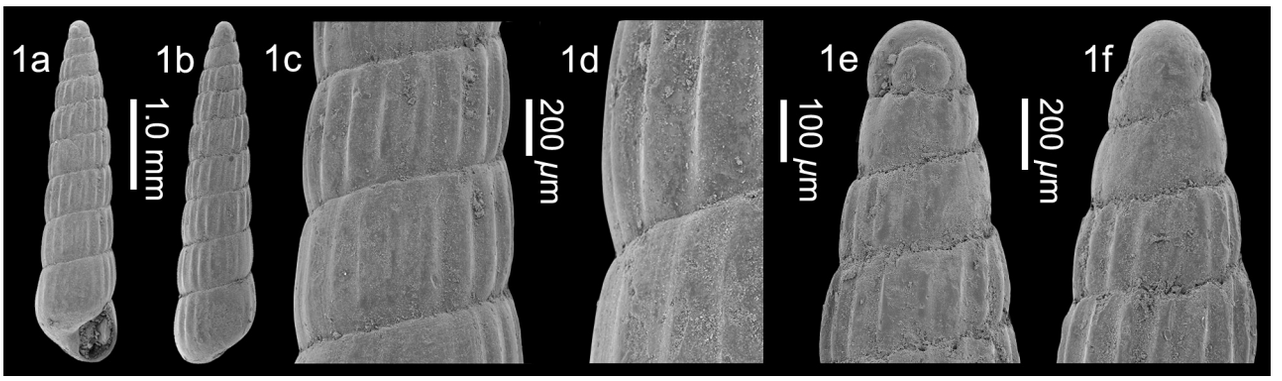

Plate 151. *Turbonilla pseudomarteli* Peñas & Rolán, 1997; 1. NHMW 2019/0167/0721, height 3.9 mm, width 935 µm, 1c, detail of teleoconch sculpture penultimate whorl, 1d, detail of spiral microsculpture, 1e-f, detail of protoconch (SEM image). Rio del Padrón, Velerín, Estepona, lower Piacenzian, upper Pliocene.

ca, and the whorls have a slower growth rate.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Mauritania (Schander, 1994), Ghana and Angola (Peñas & Rolán, 1997, 2000).

***Turbonilla pseudoterebralis* Sacco, 1892**
Plate 152, fig. 1

*1892a	*Turbonilla* (*Pyrgolampros*) *pseudoterebralis* Sacco, p. 88, pl. 2, fig. 94.
1960	*Turbonilla* (*Pyrgolampros*) *pseudoterebralis* Sacco, 1892 – Kojumdgieva & Strachimirov, p. 97, pl. 30, fig. 8.
?1984	*Turbonilla* (*Pyrgolampros*) cf. *pseudoterebralis* (Sacco, 1892) – A.W. Janssen, p. 356, pl. 17, figs 9-10.
1984	*Turbonilla* (*Pyrgolampros*) *pseudoterebralis* Sacco, 1892 – Ferrero Mortara *et al*., p. 83, pl. 13, fig. 4.
1998	*Turbonilla pseudoterebralis* Sacco, 1892 – Bogi & Cauli, p. 131, fig. 11.
2011	*Turbonilla pseudoterebralis* Sacco, 1892 – Chirli & Micali, p. 95, pl. 34, figs 13-18 (*cum syn*.).
*non*1952	*Turbonilla* (*Pyrgolampros*) *pseudoterebralis* Sacco, 1892 – Glibert, p. 60, pl. 4, fig. 15 (= *Chemnitzia* sp.).
*non*1958	*Turbonilla pseudoterebralis* (Sacco) – Sorgenfrei, p. 329, pl. 72, fig. 245.
non 2008	*Turbonilla pseudoterebralis* (Sacco, 1892) – Chirli & Richard, p. 78, pl. 15, fig. 10 (= *Turbonilla malacitana* nov. sp., above).

Material and dimensions – Maximum height 7.8 mm, width 1.6 mm. **VC**: NHMW 2019/0167/0123 (1), NHMW 2019/0167/0203 (10).

Discussion – This species, originally described based on specimens from the upper Miocene of Sant' Agata Fossili (Piemonte, Italy) (syntype figured by Ferrero Mortara *et al*., 1984, pl. 13, fig. 4), is characterised by its slender elongated pupoid profile, composed of 9-10 flat-sided whorls slightly pinched mid-whorl, separated by a deeply impressed suture, and a type B protoconch of 2.25 whorls, with the nucleus fully exposed (Estepona specimen; dp = 350 µm, hp = 340 µm, tilted 125° to main shell axis). Sculpture consists of 20-25 flattened axial ribs, slightly orthocline to prosocline, separated by narrow interspaces. There are 4-5 spiral grooves in the centre of the constrict-

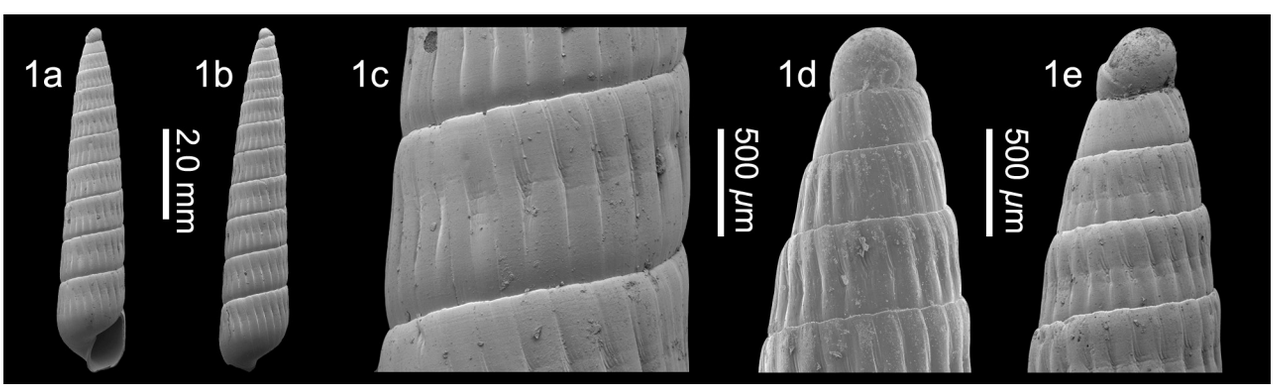

Plate 152. *Turbonilla pseudoterebralis* Sacco, 1892; 1. NHMW 2019/0167/0123, height 7.8 mm, width 1.6 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

ed mid-portion of the whorl. The aperture is small, pyriform, the columella straight, with a small fold at its adapical end. Authors that use subgenera within turbonillids have assigned this species to the subgenus *Pyrgolampros* Sacco, 1892, based on its strong rounded axials and very weak sculpture of grooves confined to mid-whorl.
The shell illustrated as *Turbonilla pseudoterebralis* by Sorgenfrei (1958, pl. 72, fig. 245) is juvenile, but is unlikely to represent this species as the protoconch is far less intorted. We have included in the chresonymy the middle Miocene Paratethian specimen illustrated by Kojumdgieva & Strachimirov (1960, pl. 30, fig. 8) from Bulgaria, which although incomplete, does seem to be conspecific.

Distribution – Middle Miocene: ?North Sean Basin, Netherlands (A.W. Janssen, 1984). Paratethys, Bulgaria (Kojumdgieva & Strachimirov, 1960). Upper Miocene: Proto-Mediterranean, Italy (Sacco, 1892a). Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla pumila* Seguenza, 1876**
Plate 153, figs 1-2

*1876 *Turbonilla pumila* Seguenza, p. 92.
1884 *Turbonilla innovata* Monterosato, p. 92.
1904 *Turbonilla stricta* Pallary, p. 236, pl. 7, fig. 7 (*non* Verrill, 1873).
1910 *Turbonilla Pallaryi* Dautzenberg, p. 95 (*nom. nov. pro T. stricta* Pallary, 1904, *non* Verrill, 1873).
1972b *Turbonilla* (*Cyrtoturbonilla*) *pseudostricta* Nordsieck, p. 124, pl. PV, fig. 22 (*nom. nov. pro T. stricta* Pallary, 1904).
1981 *Turbonilla pallaryi* Dautzenberg, 1910 – Van Aartsen, p. 71, 73, 79, pl. 5, fig. 27.
1984 *Turbonilla innovata* Monterosato, 1884 – Van Aartsen *et al*., p. 54, fig. 259.
1996 *Turbonilla pumila* Seguenza, 1876 – Peñas *et al*., p. 70, figs 165-168, 171.
1997 *Turbonilla pumila* G. Seguenza, 1876 – Peñas & Rolán, p. 28, figs 44-46.
2001 *Turbonilla pumila* G. Seguenza, 1876 – Cachia *et al*., p. 114, pl. 18, fig. 13.
2011 *Turbonilla pumila* Seguenza, G. 1876 – Chirli & Micali, p. 96, pl. 35, figs 1-6.
2011 *Turbonilla pumila* G. Seguenza, 1876 – Hernández *et al*., p. 267, fig. 90P.
2013 *Turbonilla pumila* Seguenza, G. 1876 – Öztürk & Bitlis Bakir, p. 432, fig. 22.
2014 *Turbonilla pallaryi* (Dautzenberg, 1910) – Giannuzzi-Savelli *et al*., p. 80, figs 257, 257, appendix page 30, 78.
2014 *Turbonilla pumila* G. Seguenza, 1876 – Giannuzzi-Savelli *et al*., p. 82, fig. 264, appendix page 31, 78.
2018 *Turbonilla pumila* G. Seguenza, 1876 – Trigo *et al*., p. 363, fig . 44.

Material and dimensions – Maximum height 4.8 mm,

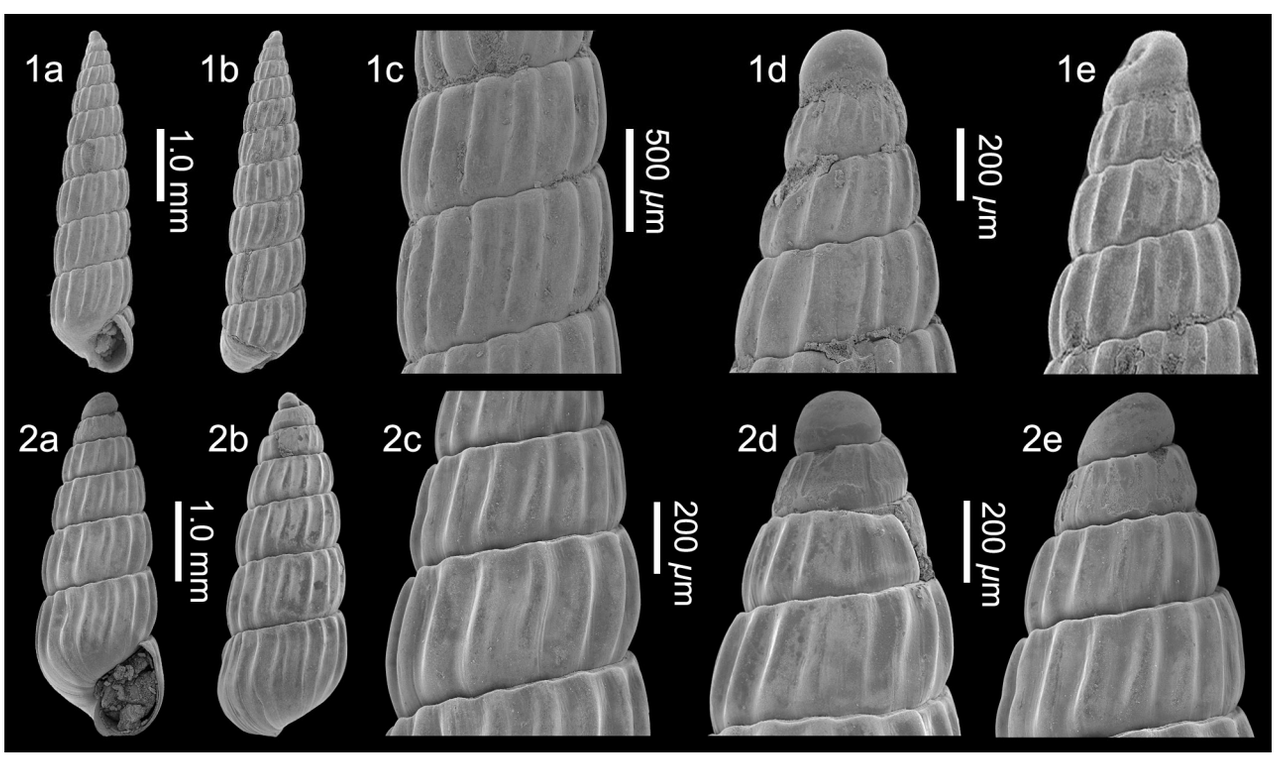

Plate 153. *Turbonilla pumila* Seguenza, 1876; 1. NHMW 2019/0167/0407, height 4.8 mm, width 1.2 mm, 1c, detail of teleoconch sculpture last two spire whorls, 1d-e, detail of protoconch. Velerín conglomerates, Velerín. 2. NHMW 2019/0167/0653, height 4.3 mm, width 1.6 mm, 2c, detail of teleoconch sculpture last two spire whorls, 2d-e, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

width 1.2 mm. **CO**: NHMW 2019/0167/0407 (1), NHMW 2019/0167/0408 (1). **EL**: NHMW 2019/0167/0653 (1), NHMW 2019/0167/0654 (5), NHMW 2019/0167/0829 (45).

Discussion – *Turbonilla pumila* Seguenza, 1876 is characterised by its tall, relatively plump shell, type B protoconch, with half the nucleus submerged (Estepona specimen; dp= 240 μm, hp = 190 μm), teleoconch of up to ten weakly convex whorls, separated by a relatively deep, undulating suture, sculpture of 16-20 broad, rounded opisthocline ribs, slightly wider than their interspaces, the ribs on the last whorl ending at the base, but without forming well-defined basal disc, smooth base, and a small aperture. The lack of a well defined basal disc places this species in the genus *Turbonilla* Risso, 1826 rather than *Chemnitzia* d'Orbigny, 1840. It is highly variable, with smaller specimens having a somewhat pupoid profile, and the ribs can be opisthocline to orthocline and narrower than those seen in the specimen from Estepona.
Turbonilla pumila is closely similar in shape and sculpture to *T. pusilla* (Philippi, 1844), but differs in having a type B protoconch whereas *T. pusilla* has a type A protoconch, although we note that the protoconch in the Estepona specimen is slightly less intorted than that illustrated by some authors (Chirli & Micali, 2011, pl. 35, fig. 4) more similar to the angle illustrated by Peñas *et al*. (1996, fig. 166) and the syntype of *T. pallaryi* Dautzenberg, 1910 (see Giannuzzi-Savelli *et al*., 2014, fig. 258). Some of the Estepona specimens fall within the *T. pallaryi* morphotype, and if found to be separated species, should be referred to that taxon.

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: European Atlantic (Van Aartsen, 1981), northwestern Spain (Trigo *et al*., 2018), south to Madeira and Selvagens Islands (Segers *et al*., 2009), Canary Islands (Peñas & Rolán, 1997; Hernández *et al*., 2011), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

***Turbonilla rosewateri* Corgan & Van Aartsen, 1993**
Plate 154, fig. 1

1904	*Turbonilla tenuis* Pallary, p. 238, pl. 7, fig. 19 (*non* Von Koenen, 1891).
1981	*Turbonilla tenuis* Pall. – Van Aartsen, p. 69, pl. 3, fig. 18.
*1993	*Turbonilla rosewateri* Corgan & Van Aartsen, p. 95 (*nom. nov. pro Turbonilla tenuis* Pallary 1904, *non* Von Koenen, 1891).
2014	*Turbonilla rosewateri* Corgan & Van Aartsen, 1993 – Giannuzzi-Savelli *et al*., p. 82, figs 269-270, appendix p. 32, 79.

Material and dimensions – Height 2.7 mm, width 810 μm. **EL**: NHMW 2019/0167/0838 (1).

Discussion – *Turbonilla rosewateri* Corgan & Van Aartsen, 1993 is characterised by its subconical profile, weakly to moderately convex whorls, protoconch type A2 (Estepona specimen; dp = 195 μm, hp = 220 μm, tilted at angle of 115° to main shell axis), first 1-2 teleoconch whorls often smooth, succeeding whorls with straight opisthocline ribs, twice the width of their interspaces, ribs weakening towards the periphery on the last whorl, but not as abruptly as in members of the genus *Chemnitzia* d'Orbigny, 1840. The protoconch in the Estepona specimen is slightly smaller and less inclined than that of extant specimens (dp = 230 μm, tilted at 120° to main shell axis; *fide* Giannuzzi-Savelli *et al*., p. 32, 79).
It is closely similar to *T. acuta* (Donovan, 1804), which can only be separated reliably by the protoconch which is of type A1.
This is the first fossil record for this species that today is restricted to the Gulf of Gabés (Tunisia).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: central Mediterranean (Pallary, 1904; Giannuzzi-Savelli *et al*., 2014).

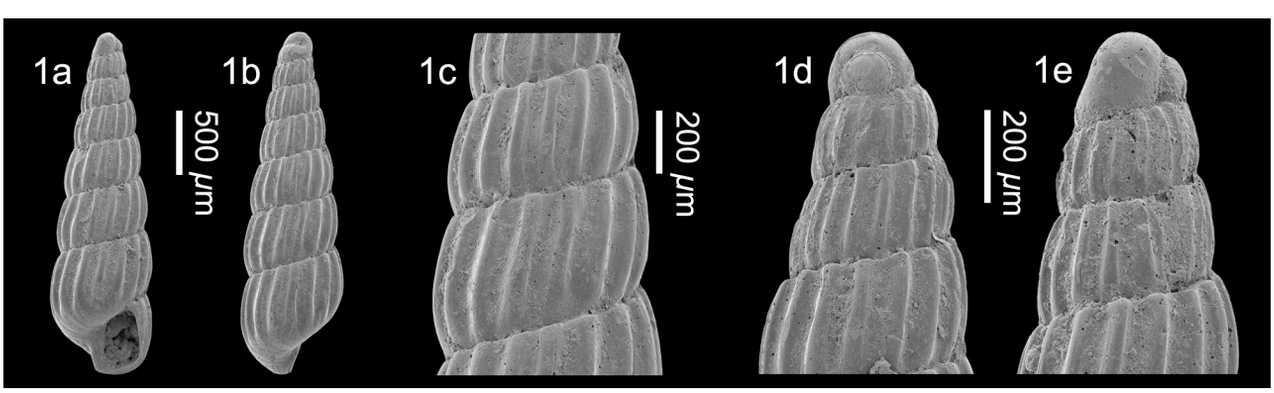

Plate 154. *Turbonilla rosewateri* Corgan & Van Aartsen, 1993; 1. NHMW 2019/0167/0838, height 2.7 mm, width 810 μm, 1c, detail of teleoconch sculpture last two teleoconch whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

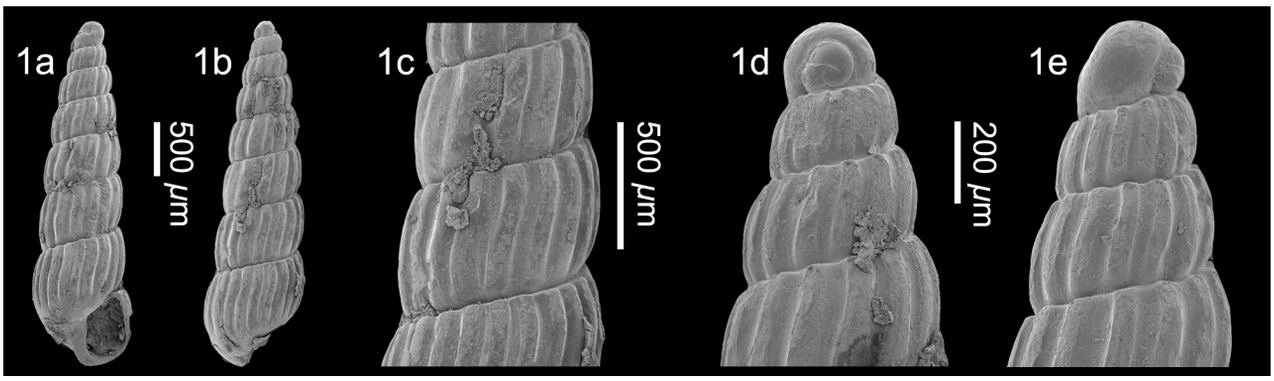

Plate 155. *Turbonilla subulina* Monterosato, 1889; 1. NHMW 2019/0167/0435, height 3.2 mm, width 905 μm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

***Turbonilla subulina* Monterosato, 1889**
Plate 155, fig. 1

*1889	*Turbonilla subulina* Monterosato, p. 38.
1912	*Turbonilla obliquecostata* Dautzenberg, p. 60, pl. 2, figs 30-31.
1912	*Turbonilla bedoti* Dautzenberg, p. 63, pl. 2, figs 39-40.
1920	*Turbonilla hannoni* Pallary, p. 62, pl. 1, fig. 12.
1992	*Turbonilla subulina* Monterosato, 1889 – Gaglini, p. 165, fig. 178.
1996	*Turbonilla bedoti* Dautzenberg, 1913 [*sic*] – Peñas *et al*., p. 60, figs 194-196)
1997	*Turbonilla subulina* Monterosato, 1889 – Peñas & Rolán, p. 44, figs 96-102.
2014	*Turbonilla subulina* Monterosato, 1889 – Giannuzzi-Savelli *et al*., p. 82, fig. 271, 272, appendix p. 32, 79.
2014	*Turbonilla subulina* Monterosato, 1889 – Peñas *et al*., p. 196, fig. 30H.

Material and dimensions – Height 3.2 mm, width 905 μm. **EL**: NHMW 2019/0167/0435 (1).

Discussion – *Turbonilla subulina* Monterosato, 1889 is characterised by its small size, slender spire, A2 type protoconch of just over two whorls (Estepona specimen; dp = 227 μm, hp = 230 μm, dn = 80 μm, tilted at about 110° to main shell axis), teleoconch of up to nine convex whorls separated by a relatively deep, oblique suture, sculpture of broad, rounded, slightly sinuous, opisthocline ribs, equal to or slightly wider than their interspaces, the last whorl is evenly rounded, the ribs stopping abruptly at the periphery, but without forming a basal disc, base smooth, the aperture is small, and the columella bears a low subobsolete fold. Peñas & Rolán (1997, p. 44) considered the extant populations relatively variable in regards to the convexity of the whorls and the presence or absence of a subsutural cord, which is not present in the Estepona specimens. The protoconch is slightly smaller than that described for a recent specimen from Ghana (dp = 240-246 μm; Peñas & Rolán, 1997). This is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic: Morocco southwards to Angola (Peñas & Rolán, 1997, Peñas *et al*., 2014), western Mediterranean (Peñas *et al*., 1996; Giannuzzi-Savelli *et al*., 2014).

***Turbonilla tabanellii* Bongiardino & Micali, 2018**
Plate 156, fig. 1

*2018	*Turbonilla tabanellii* Bongiardino & Micali, p. 104, figs 1F, H.

Material and dimensions – Maximum height 2.5 mm, width 890 μm. **VC**: NHMW 2019/0167/0103 (1), NHMW 2019/0167/0104 (13). **EL**: NHMW 2019/0167/0731 (2).

Discussion – *Turbonilla tabanellii* Bongiardino & Micali, 2018 is characterised by its relatively squat shell for the genus composed of about six whorls; early whorls convex, abapically straight-sided and last two whorls slightly constricted mid-whorl, resulting in concave profile, separated by moderately impressed undulating suture, and type B protoconch of 2.25 whorls, with the nucleus exposed (Estepona specimen; dp = 360 μm; hp = 345 μm; dn = 70 μm, tilted at about 132° to main shell axis). Sculpture of 14-16 rounded orthocline to slightly prosocline ribs, roughly half the width of their interspaces, weakening over the base and close-set spiral grooves that cut into the axials and persists onto the base. The specimen figured from Estepona is closely similar to the type series illustrated by Bongiardino & Micali (2018), although it is possibly not fully adult, composed of only four whorls, and the axial ribs are orthocline as opposed to weakly prosocline. *Turbonilla multilirata* (Monterosato, 1875) from the present-day central and eastern Mediterranean and Italian upper Pliocene (Bongiardino & Micali, 2018, p. 104) is the only extant species with similar sculpture, but differs in being larger, with a wider apical angle and having flat-sided whorls as opposed to slightly concave mid-whorl as seen in *T. tabanellii*.

Distribution – Lower Pliocene: central Proto-Mediterra-

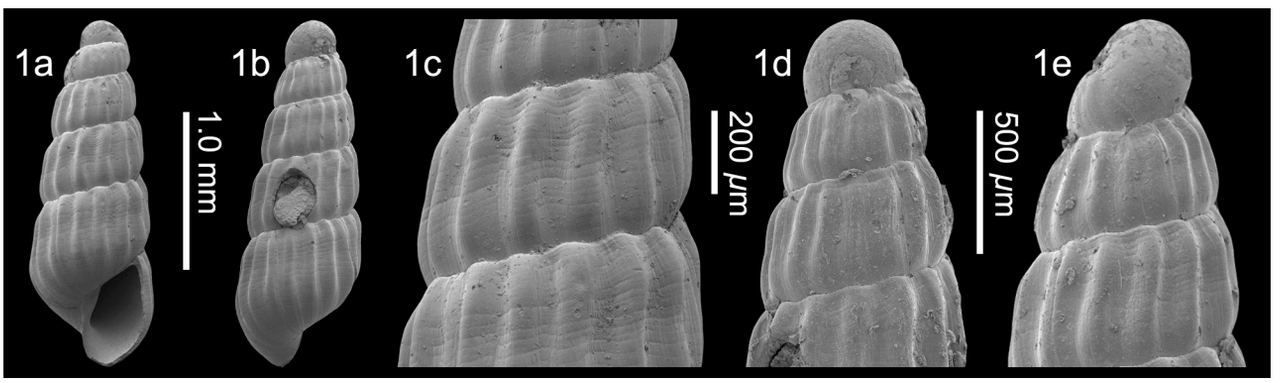

Plate 156. *Turbonilla tabanellii* Bongiardino & Micali, 2018; 1. NHMW 2019/0167/0103, height 2.5 mm, width 890 μm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

nean, Italy (Bongiardino & Micali, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Proto-Mediterranean, Italy (Bongiardino & Micali, 2018).

***Turbonilla unica* (Boettger, 1902)**
Plate 157, fig. 1

*1902	*Pyrgulina unica* Boettger, p. 106.
1906	*Pyrgulina minima* (M. Hö.) – Boettger, p. 123 (*non Chemnitzia minima* Hörnes, 1856).
1934	*Chrysallida* (*Pyrgulina*) *minima* (M. Hoernes) – Zilch, p. 235, pl. 11, fig. 1 (*non Chemnitzia minima* Hörnes, 1856).

Material and dimensions – Maximum height 3.4 mm, width 1.1 mm. **VC**: NHMW 2019/0167/0107 (1), NHMW 2019/0167/0108 (5). **EL**: NHMW 2019/0167/0727 (1).

Discussion – *Turbonilla unica* (Boettger, 1902) was described based on a specimen from the middle Miocene Paratethys, Kostej, Romania. Subsequently, Boettger (1906, p. 123) considered his species merely a strongly sculptured form of *Chemnitzia minina* Hörnes, 1856. We fail to see the similarity, as Hörnes' species (1856, pl. 43, fig. 22) differs considerably from the illustration of the lectotype of Boettger's species given by Zilch (1934, pl. 11, fig. 1) in being slenderer, with taller whorls, weaker sculpture, and lacks the subsutural collar typical of Boettger's species. The two are unlikely to be congeneric.
The specimens from Estepona are remarkably similar to the lectotype illustrated by Zilch. The specimen illustrated herein has an extra whorl, the profile is slightly more conical rather than cylindrical as in the Paratethyan lectotype, and the whorls are slightly lower and less convex. Nevertheless, the axial sculpture and subsutural collar, which is an unusual feature, are extremely similar to the lectotype, and we provisionally consider them conspecific.
Generic placement is problematic. Boettger's original placement in the genus *Pyrgulina* A. Adams, 1863 is incorrect. The profile is quite different to that of the type species *Chrysallida casta* A. Adams, 1861 from present-day, Japan (syntype: Museums Victoria No. F 31485; https://collections.museumsvictoria.com.au/specimens/604027) and the species included in that genus herein. In our opinion it is more likely to be a turbonillid in the widest sense.
Turbonilla pyrgidium Tomlin & Shackleford, 1914 from present-day West Africa (see Peñas & Rolán, 1997) has a

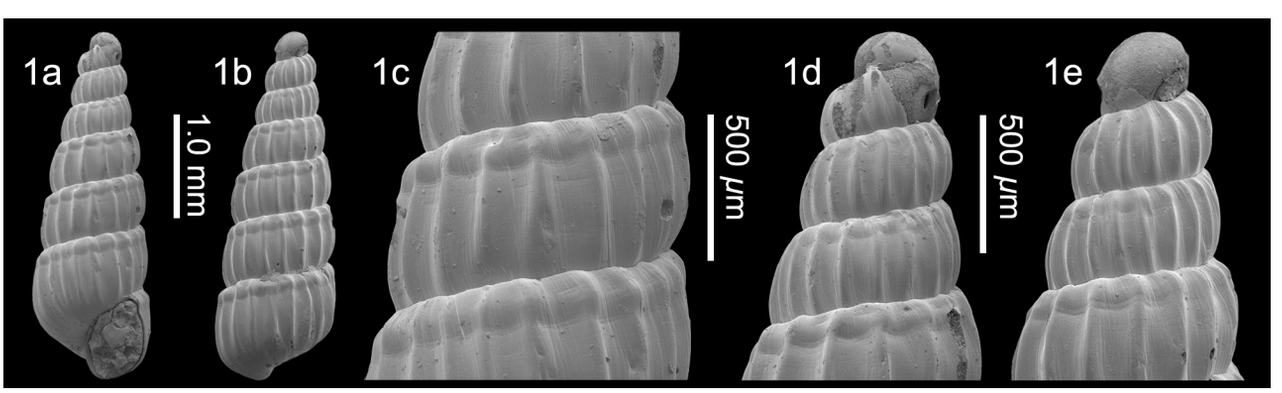

Plate 157. *Turbonilla unica* (Boettger, 1902); 1. NHMW 2019/0167/0107, height 3.4 mm, width 1.1 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

similar outline with subsutural collar, but is sub-cylindrical instead of conical, with turriculate whorls.

Distribution – Middle Miocene: Paratethys, Romania (Boettger, 1902, 1906; Zilch, 1934). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Turbonilla velerinensis* nov. sp.**
Plate 158, fig. 1

Type material – Holotype NHMW 2019/0167/0506, height 7.1 mm, width 1.7 mm.

Other material – **EL**: NHMW 2019/0167/0847 (6).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after type locality of Velerín. *Turbonilla* gender feminine.

Diagnosis – *Turbonilla* species of medium size, slender, tall, regularly conical spire, type A2 protoconch, teleoconch of up to 11 convex whorls, deep suture, weak, sinuous opisthocline ribs, 15 on penultimate whorl, well-developed basal disc.

Description – Shell of medium size for genus, tall slender, with regularly conical profile. Protoconch type A2, with 1.75 whorls, nucleus medium sized, fully exposed (dp = 315 μm, hp = 240 μm, dn = 113 μm, tilted at about 115° to main shell axis), teleoconch of 11 moderately convex whorls, separated by steeply inclined suture, sculpture of low, poorly delimited, sinuous, strongly opisthocline axial ribs, 15 on penultimate whorl, separated by interspaces 2-3 times as broad as ribs. Last whorls convex, 29% of total height, ribs ending at the periphery, but without forming well-defined basal disc, base smooth, imperforate. Aperture small, 17% of total height (characters obscured by matrix).

Discussion – *Turbonilla velerinensis* nov. sp. is quite distinctive species, with its paucispiral type A2 protoconch, tall, slender shell and weakly developed axial sculpture, and warrants formal description. The lack of a well defined basal disc places this species in the genus *Turbonilla* Risso, 1826 rather than *Chemnitzia* d'Orbigny, 1840. It is similar to *Turbonilla hoeki* Dautzenberg & Fischer, 1896 from the Azores (see Peñas & Rolán, 1999, figs 77-81), but that species has the nucleus almost fully immersed in the first whorl, the ribs are orthocline instead of opisthocline, and persist weakened over the base.

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

***Turbonilla* sp. 1**
Plate 159, fig. 1

Material and dimensions – Height 9.0 mm, width 2.5 mm. **VS**: NHMW 2019/0167/0528 (1).

Description – Shell slender, tall conical, slightly cyrtoconoid early spire profile. Protoconch large, type B, about two whorls, with nucleus almost completely exposed (dp = 365 μm, hp = 335 μm, tilted at about 125° to main shell axis). Teleoconch of nine whorls, first two whorls convex, flatter-sided abapically, separated by weakly impressed, linear suture. Sculpture of narrow orthocline ribs, about half width of their interspaces, axial growth lines visible in interspaces; ribs more numerous on initial two teleoconch whorls, abapically becaming more acute and wider spaced. Last whorl 33% total height, rounded at periphery, ribs weakening at periphery, not extending onto base, but without forming basal disc, base smooth, imperforate. Aperture pyriform-subquadrate, 18% total height, outer lip rounded, not flared abapically, columella short, vertical, without fold.

Discussion – Among the fossil species having a type B protoconch and acute ribs, none are similar enough to warrant comparison. *Turbonilla paucicostata* Seguenza, 1876, originally described from the Pliocene of Altavilla was considered by Sacco (1892a, p. 75) a

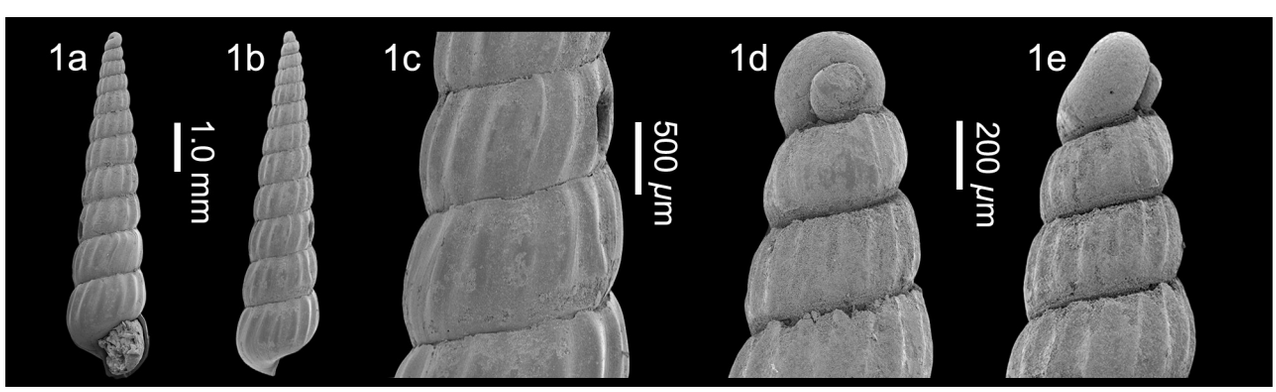

Plate 158. *Turbonilla velerinensis* nov. sp.; 1. **Holotype** NHMW 2019/0167/0505, height 7.1 mm, width 1.7 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín Carretera, Estepona, lower Piacenzian, upper Pliocene.

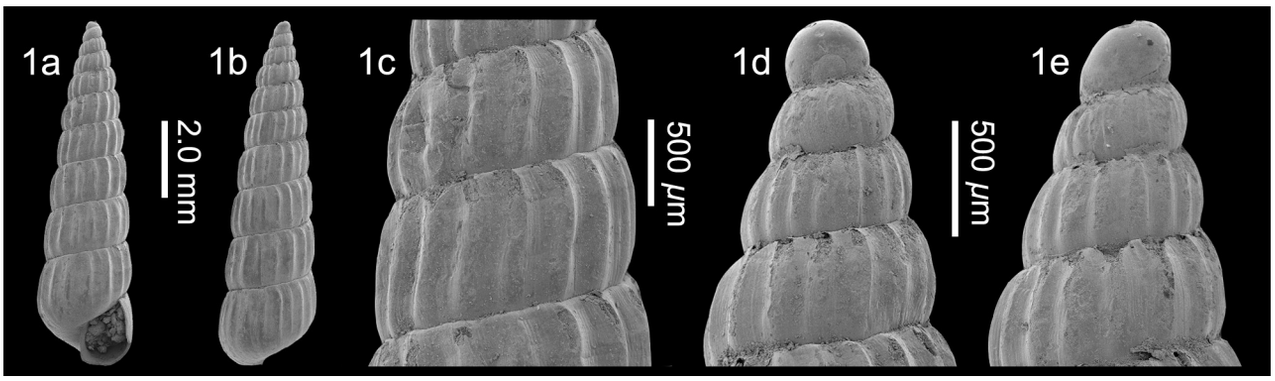

Plate 159. *Turbonilla* sp. 1; 1. NHMW 2019/0167/0528, height 9.0 mm, width 2.5 mm, 1c, detail sculpture 5th and 6 th teleoconch whorls, 1d-e, detail of protoconch (SEM image). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

variety of *C. lactea* (Linneaus, 1758) and reported from the middle Pliocene of the area near Savona, mainly consisting of deep-sea deposits. Sacco's description is more detailed than original description and differentiates this variety from *C. campanellae* (Philippi, 1836) in being smaller sized, having a more conical profile, whorls slightly more convex, ribs narrower and more acute. These characters are not sufficient to characterise the species definitively. Unfortunately, material from the Seguenza collection is missing (see under *Turbonilla plioalboranensis*).

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

***Turbonilla* sp. 2**
Plate 160, fig. 1

Material and dimensions – Height 3.6 mm, width 1.2 mm. **EL**: NHMW 2019/0167/0685 (1), NHMW 2019/0167/0833 (12).

Description – Shell solid, cyrtoconoid. Protoconch type A2 tending to B (dp = 325µm, tilted at angle of 115° to main shell axis). Teleoconch of five weakly convex whorls, separated by moderately impressed, weakly undulating suture. Sculpture of straight, rounded, orthocline axial ribs, 14 on penultimate whorl, half width of their interspaces, and very fine spiral cords cover entire surface overrunning ribs. Last whorl 46% total height, weakly convex, rounded at base, axials weakening at periphery, not extending onto base. Aperture pyriform, small, Columella slightly oblique, strongly thickened, without fold.

Discussion – At first glance this species resembles *Turbonilla costifera* Smith, 1872 from West Africa (see Peñas & Rolán, 1997, figs 154-160. However, the similarity is superficial. In that species the spiral grooves are macroscopic, 12 in number, restricted to the axial interspaces whereas in the Estepona species the spirals are very fine and much more numerous, overrunning the cords. Moreover, the protoconch is more strongly tilted in *T. costifera*, of type B, with the nucleus partly obscured. Other species showing a microscopic spiral sculpture as *T. nofronii* Peñas & Rolán, 1997, *T. pseudomarteli* Peñas & Rolán, 1997, *T. fulgidula* (Jeffreys, 1884) and *T. bengoensis* Peñas & Rolán, 1997, but all these have a type A2 protoconch coiled at about 90° and do not have the whorls flat, restricted at both extremities.

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

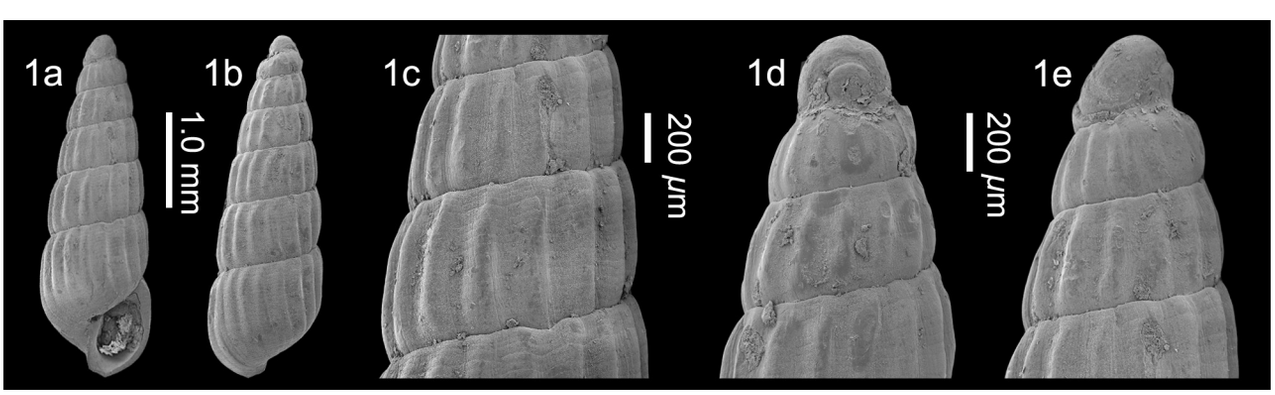

Plate 160. *Turbonilla* sp. 2; 1. NHMW 2019/0167/0685, height 3.6 mm, width 1.2 mm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Tribe Eulimellini Saurin, 1958
Genus *Eulimella* Forbes & MacAndrew, 1846

Type species – *Eulima macandrei* Forbes, 1844 (= *Melania scillae* Scacchi, 1835), by original designation, present-day, Europe.

1846 *Eulimella* Forbes & MacAndrew, p. 1027.
1861 *Aciculina* Deshayes, p. 530. Type species (by typification of replacement name [ICZN, 1999, Art. 79.2.3] *Belonidium* Cossmann, 1893): *Aciculina gracilis* Deshayes, 1861, Eocene, France.
1880 *Anisocycla* Monterosato, p. 72. Type species (by monotypy): *Odostomia ventricosa* Forbes, 1844, Recent, Agean Sea (see discussion by Warén, 2013, p. 3).
1893 *Belonidium* Cossmann, p. 350. Type species (by original designation): *Aciculina gracilis* Deshayes, 1861, Eocene, France. *Nom. nov. pro Aciculina* Deshayes, 1861, *non* A. Adams, 1853 (Gastropoda: Nassariidae).
1959 *Instarella*, Laseron, p. 249, figs 211, 212. Type species (by original designation): *Instarella subcarina* Laseron, 1959, present-day, Northern Territory, Australia.
1959 *Zonella*, Laseron, p. 248, figs 208, 209. Type species (by original designation): *Odostomia amoebaea* Watson, 1886, present-day, Queensland, Australia.

***Eulimella acicula* (Philippi, 1836)**
Plate 161, figs 1-3

*1836 *Melania acicula* Philippi, p. 135, pl. 9, fig. 6.
?1844 *Eulima affinis* Philippi, p. 135, pl. 24, fig. 7.
1848 *Chemnitzia similis* Forbes – S.V. Wood, p. 84, pl. 10, fig. 11.
1868 *Eulimella subcylindrata* Dunker *in* Weinkauff, p. 225.
1882 *Eulimella* (*Melania*) *acicula* Philippi – Bucquoy *et al*., p. 187, pl. 20, figs 17, 18.
1892a *Eulimella acicula* var. *magnoturris* Sacco, p. 53, pl. 2, fig. 11
1923 *Eulimella acicula* (Philippi) – Harmer, p. 845, pl. 64, fig. 30.
1952 *Eulimella acicula* Philippi, 1836 – Glibert, p. 56, pl. 4, fig. 2.
1963 *Eulimella* (*Eulimella*) *acicula* (Philippi) – Venzo & Pelosio, p. 78, pl. 34, figs 24-25.
1964 *Eulimella* (*Eulimella*) *laevis* (Brown, 1827) – Van Regteren Altena *et al*., p. 5, pl. 21, fig. 197
1964 *Eulimella acicula* Philippi, 1836 – Brébion, p. 290, pl. 7, figs 13, 14.
1969 *Eulimella acicula* Philippi – Fekih, p. 50, pl. 10, fig. 5, pl. 11, fig. 6.
1984 *Eulimella* (*Eulimella*) *acicula* (Philippi, 1836) – A. W. Janssen, p. 346, pl. 16, fig. 6.
1986 *Eulimella laevis* (Brown, 1827) – Fretter *et al*., p. 626, fig. 436.
1988 *Eulimella laevis* (Brown, 1827) – Graham, p. 614, fig. 268.
1992 *Eulimella acicula* (Philippi, 1836) – Cavallo & Repetto, p. 156, fig. 434.
1994 *Eulimella acicula* (Philippi, 1836) – Van Aartsen, p. 96, fig. 15.
1995 *Eulimella subcylindata* (Dunker in Weinkauff, 1862) – Nofroni & Tringali, p. 31, pl. 3, figs 9-10, pl. 4, figs 13-16.
1996 *Eulimella acicula* (Philippi, 1836) – Peñas *et al*., p. 33, figs 69, 75.
1997b *Eulimella* (*E.*) *acicula* (Philippi, 1836) – Marquet, p. 106, pl. 9, fig. 9.
1998 *Eulimella* (*E.*) *acicula* (Philippi, 1836) – Wilke & Van Aartsen, p. 11, pl. 6, fig. 21a, b.
1998 *Eulimella* (*E.*) *acicula* (Philippi, 1836) – Marquet, p. 192, fig. 164.
2001 *Eulimella acicula* (Philippi, 1836) – Cachia *et al*., p. 94, pl. 15, fig. 4.
2005 *Eulimella* (*Eulimella*) *acicula* (Philippi, 1836) – Schnetler, p. 121, pl. 9, fig. 5.
2011 *Eulimella acicula* (Philippi, 1836) – Chirli & Micali, p. 7, pl. 1, figs 12-15, pl. 2, figs 1-3.
2011 *Eulimella subcylindata* (Dunker in Weinkauff, 1862) – Chirli & Micali, p. 18, pl. 5, figs 1-4.
2011 *Eulimella acicula* (Philippi, 1836) – Chirli & Linse, p. 199, pl. 75, fig. 3.
2011 *Eulimella acicula* (Philippi, 1836) – Hernández *et al*., p. 254, figs 87P-R.
2013 *Eulimella acicula* (Philippi, 1836) – Öztürk & Bakir, p. 427, fig. 6.
2014 *Eulimella acicula* (Philippi, 1836) – Peñas *et al*., p. 169, figs 23A-D.
2014 *Eulimella acicula* (Philippi, 1836) – Giannuzzi-Savelli *et al*., p. 86, figs 292, 293, appendix p. 35, 82.
2018 *Eulimella acicula* (Philippi, 1836) – Trigo *et al*., p. 361, fig. 14.

non 1892a *Eulimella acicula* var. *postsubcylindrica* Sacco, p. 53, pl. 2, fig. 12 (=*Eulimella postsubcylindrica* Sacco, 1892).

Material and dimensions – Maximum height 3.3 mm, width 860 μm. **CO**: NHMW 2019/0167/0459 (1). **EL**: NHMW 2019/0167/0457 (1), NHMW 2019/0167/0458 (10), NHMW 2019/0167/0865 (1).

Discussion – *Eulimella acicula* (Philippi, 1836) is characterised by its very slender subconical shell, type A2 protoconch composed of three whorls, tilted at just over 90° to the main shell axis, almost flat-sided whorls separated by a weakly impressed suture, orthocline to weakly opisthocline growth lines, usually devoid of spiral sculpture, although populations living in muddy substrates can have fine spirals. Similarly finely striate specimens from present-day Mauritania were illustrated by Peñas *et al*. (2014, figs 23C-D), and are also present in Estepona (Pl. 161, fig. 3e).
Eulima subcylindata Dunker *in* Weinkauff, 1862 has

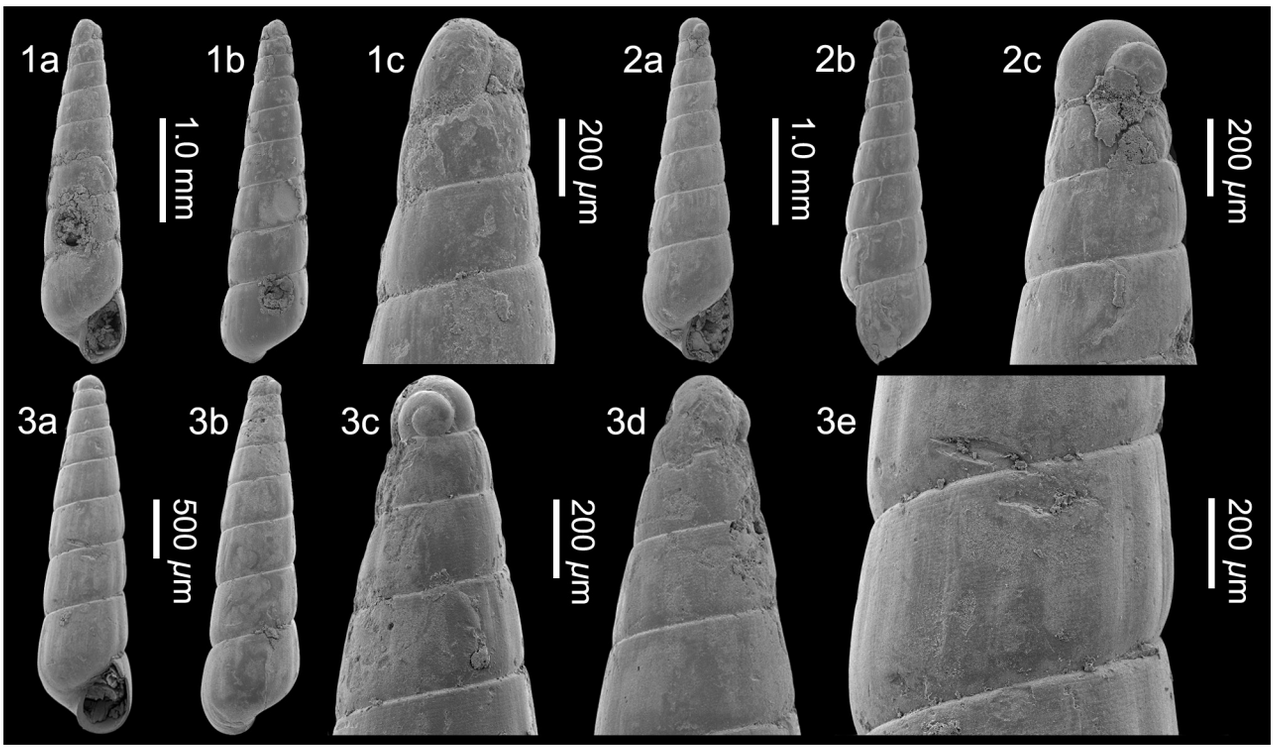

Plate 161. *Eulimella acicula* (Philippi, 1836); 1. NHMW 2019/0167/0457, height 3.3 mm, width 810 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0457, height 3.3 mm, width 860 μm, 2c, detail of protoconch; 3. NHMW 2019/0167/0865, height 3.1 mm, width 795 μm, 3c-d, detail of protoconch, 3e, detail of spiral microsculpture penultimate whorl (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

been synonymised with *Eulimella acicula* (Philippi, 1836) by some authors (Peñas & Rolán, 1997, Chirli & Micali, 2011; Giannuzzi-Savelli *et al*., 2014). However, Nofroni & Tringali (1995) considered them to be separate species based on protoconch characters. Although they both have a type A2 protoconch, that of *Eulimella subcylindrata* is consistently smaller than that of *E. acicula*. Moreover *E. subcylindrata* has a narrower first whorl, giving the spire a more pointed aspect. Peñas & Rolán (2014, p. 170) "*after examination of hundreds of shells*" again considered them synonyms. We follow this position herein.

Distribution – Lower-middle Miocene: North Sea Basin, Netherlands (Janssen, 1984). Middle Miocene: western Proto-Mediterranean, NE Spain (Moreno *et al*., 2003). Upper Miocene: North Sean Basin (Tortonian), Denmark (Schnetler, 2005), Belgium (Glibert, 1952); Atlantic (Messinian), northwestern France (Brébion, 1964; Landau *et al*., 2020); Proto-Mediterranean, Italy (Venzo & Pelosio, 1963). Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1848; Harmer, 1823), Kruisschans sands, Belgium (Marquet, 1998); Atlantic, northwestern France (Brébion, 1964); central Mediterranean (Crovato & Micali, 1992b; Chirli & Micali, 2011), Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, Red Crag, England (Harmer, 1823), Oorderen sands (Marquet, 1998); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992). Pliocene (indeterminate): North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964). Upper Pliocene-Pleistocene: Atlantic, northwestern France (Brébion, 1964). Lower Pleistocene: North Sea Basin, Netherlands (Van Regteren Altena *et al*., 1964); Atlantic, St. Erth, England (Harmer, 1923); central Mediterranean, Italy (Brunetti, 2011); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Upper Pleistocene: Atlantic, Ireland (Harmer, 1923). Present-day: eastern Atlantic frontage to British Isles and southern Norway (Fretter *et al*., 1986), northwestern Spain (Trigo *et al*., 2018), south to Canaries (Hernández *et al*., 2011), Senegal and Guinea-Bissau (Peñas *et al*., 2014), western Mediterranean (Bucquoy *et al*., 1882; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Micali & Palazzi, 1992; Öztürk & Bitlis Bakir, 2013).

Eulimella angeli Peñas & Rolán, 1997

Plate 162, fig. 1

*1997	*Eulimella angeli* Peñas & Rolán, p. 88, figs 239-246.
2014	*Eulimella angeli* Peñas & Rolán, 1997 – Peñas *et al*., p. 170, figs 23E-F.

Material and dimensions – Maximum height 4.8 mm, width 1.4 mm. **VC**: NHMW 2019/0167/0867 (2). **EL**: NHMW 2019/0167/0670 (1), NHMW 2019/0167/0671 (1).

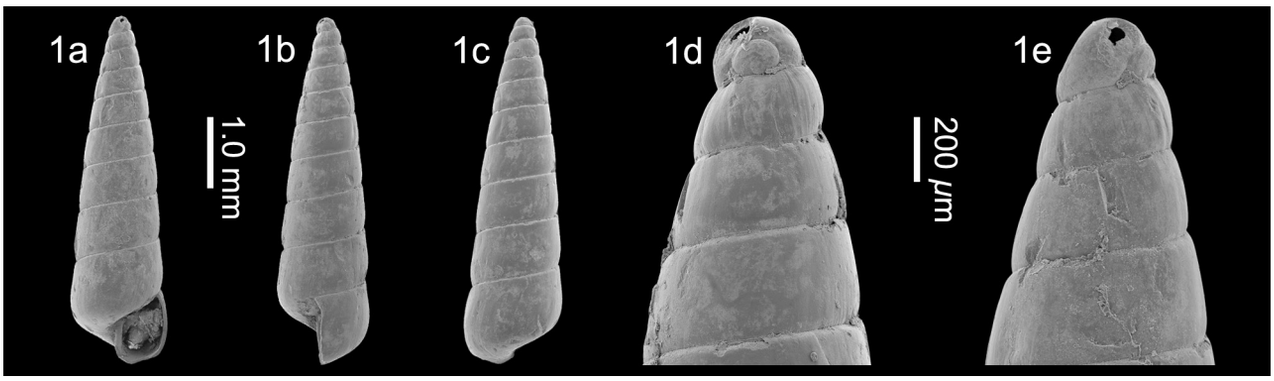

Plate 162. *Eulimella angeli* Peñas & Rolán, 1997; 1. NHMW 2019/0167/0670, height 4.8 mm, width 1.4 mm, 1c-d, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Discussion – *Eulimella angeli* Peñas & Rolán, 1997 is characterised by its slightly cyrtoconoid conical shell, type A2 protoconch of about 2.25 whorls, with the nucleus exposed and prominent (Estepona specimen dp = 285 μm, dn = 60 μm, tilted at 107° to main shell axis), tall spire composed of flat-sided whorls, opisthocline, sinuous growth lines, and subquadrate aperture with a vertical columella without a fold. The size of the protoconch in the Estepona specimen fits within the range given for the extant shells (285-295; Peñas & Rolán, 1997, p. 88), although the nucleus is less protruding, and it lacks the microsculpture of spiral rows of pits in a narrow subsutural zone and very small scattered pits over the entire whorls described by those authors, however, the surface of the fossil shell is somewhat abraded. It is similar to *E. hoeisaeteri* Micali 2021 from which it differs for the slight cyrtoconoid outline, the more exposed protoconch nucleus, and the deeper suture.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic Bay of Biscay, Mauritania (Van Aartsen *et al*., 2000) south to Angola (Peñas & Rolán, 1997; Peñas *et al*., 2014).

***Eulimella ariejansseni* nov. sp.**
Plate 163, figs 1-4

Type material – Holotype NHMW 2019/0167/0573, height 3.0 mm, width 845 μm; paratype 1 NHMW 2019/0167/0582, height 4.1 mm, width 960 μm; paratype 2 NHMW 2019/0167/0502, height 3.9 mm, width 1.0 mm; paratype 3 NHMW 2019/0167/0503, height 3.9 mm, width 1.0 mm.

Other material – Maximum height 4.1 mm, width 960 μm. **VC**: NHMW 2019/0167/0590 (8).

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

Type stratum – lower Piacenzian, Upper Pliocene.

Etymology – Named after the late Arie W. Janssen (1937-2021) to whom this volume of Cainozoic Research is dedicated. Esteemed colleague and friend of the first author, he will be missed. *Eulimella* gender feminine.

Diagnosis – *Eulimella* species of small size, type A2 protoconch with large, fully exposed nucleus, teleoconch of up to ten convex whorls separated by weakly impressed suture, spire whorls with narrow, poorly-delimited subsutural collar, surface smooth, except for slightly opisthocline growth lines, last whorl evenly rounded.

Description – Shell small, tall, slender, conical spire. Protoconch type A2, 1.75 whorls, with large nucleus fully exposed (dp = 200-210 μm, hp = 170-200 μm, dn = 90 μm, tilted at 113° to main shell axis). Teleoconch of up to ten convex whorls, with periphery below mid-whorl, separated by weakly impressed suture, spire whorls developing narrow, poorly-delimited subsutural collar. Surface smooth, except for slightly opisthocline growth lines. Last whorl 30-34% of total height, evenly rounded, base not delimited. Aperture small, 17-20% of total height, outer lip thin, evenly rounded, not expanded abapically. Columella vertical, slightly thickened.

Discussion –In having a subsutural collar, *Eulimella ariejansseni* nov. sp. is similar the Pliocene Mediterranean *Eulimella roeri* (Pavia, 1976), but that species differs in having a less tilted protoconch (100°; Pavia, 1976, p. 161), a more cylindrical outline, lower whorls (mainly the initial ones), the subsutural collar is more strongly developed, and prosocline growthlines.
Eulimella suturofunata Fekih, 1969 from lower Pliocene of Tunisia was poorly described and figured, so that a comparison is not possible considering the very subtle differences in shell morphology between *Eulimella* species.
Some present-day species from West Africa show a subsutural cord at the adapical suture. *Eulimella polygirata* Dautzenberg, 1912 differs in having a type A1 protoconch of half whorl more, and prosocline growth lines. *Eulimella perturbata* Peñas, Rolán & Swinnen, 2014 differs again in having a type A1 protoconch of half whorl

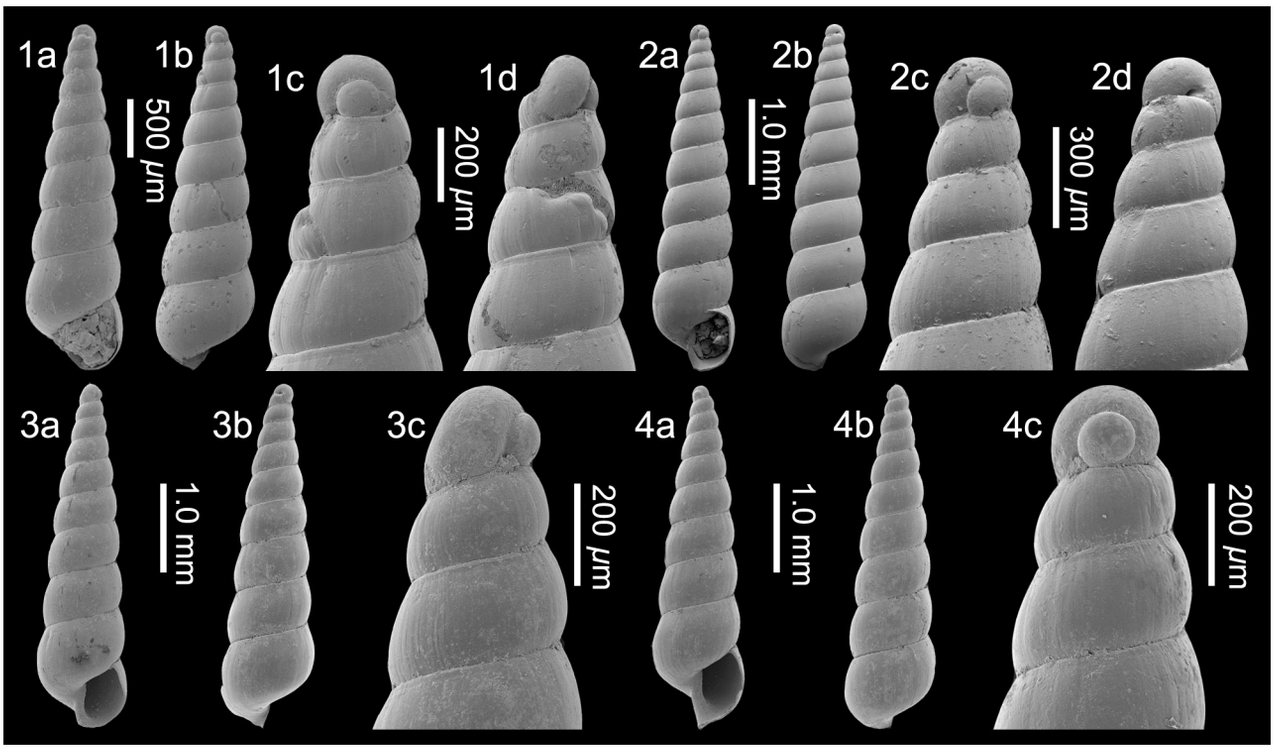

Plate 163. *Eulimella ariejansseni* nov. sp.; 1. **Holotype** NHMW 2019/0167/0573, height 3.0 mm, width 845 µm, 1c-d, detail of protoconch; 2. **Paratype 1** NHMW 2019/0167/0582, height 4.1 mm, width 960 µm, 2c-d, detail of protoconch; 3. **Paratype 2** NHMW 2019/0167/0502, height 3.9 mm, width 1.0 mm, 3c, detail of protoconch; 4. **Paratype 3** NHMW 2019/0167/0503, height 3.9 mm, width 1.0 mm, 4c, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

more, and a more cylindrical profile. *Eulimella kobelti* (Dautzenberg, 1912) differs again in its type A1 protoconch of half whorl more, prosocline growth lines, and a cylindrical outline. *Eulimella zornikulla* Schander, 1994 is also more cylindrical, has a more protruding protoconch, growth lines direction is not indicated in the original description.

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

***Eulimella clavatula* Sacco, 1892**
Plate 164, fig. 1

*1892a	*Eulimella subumbilicatoides* var. *clavatula* Sacco, p. 56, pl. 2, fig. 21.
2011	*Eulimella clavatula* Sacco, 1892 – Chirli & Micali, p. 9, pl. 2, figs 4-8.

Material and dimensions – Height 3.2 mm, width 790 µm. **EL**: NHMW 2019/0167/0868 (1).

Discussion – *Eulimella clavatula* Sacco, 1892 is characterised by its very tall, slender shell composed of 8-9 flat-sided whorls separated by a moderately impressed linear suture, type A2 protoconch of 2.5 whorls (Estepona specimen; dp = 323 µm, hp = 350 µm, dn = 95 µm, set at 90° to main shell axis), prosocline growth lines on the teleoconch whorls, small rhomboidal aperture, slightly oblique columella and fold deep within aperture, not visible when outer lip complete. Initially described as a variety of *E. subumbilicatoides*, it differs in having a slenderer shell, with a smaller protoconch (dp = 250 µm vs 275-280 µm), narrower last whorl. *Eulimella kobelti* (Dautzenberg, 1912) from present-day West Africa is closely similar in shape, but differs in having a larger type A1 instead of A2 markedly protruding protoconch (dp = 369 µm; *fide* Peñas & Rolán, 1997, p. 83) the nucleus of the protoconch smaller and less pronounced, and the suture

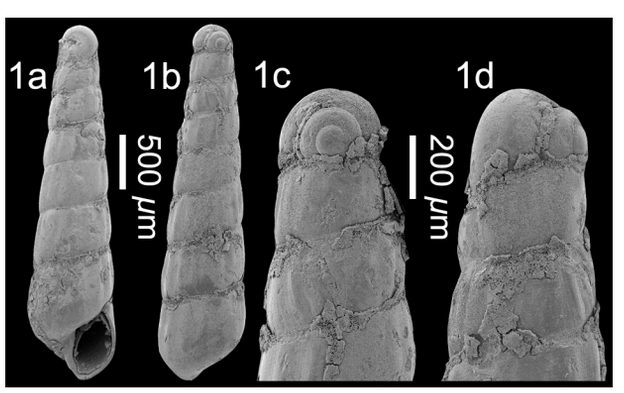

Plate 164. *Eulimella clavatula* Sacco, 1892; 1. NHMW 2019/0167/0868, height 3.2 mm, width 790 µm, 1c-d, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

on the early teleoconch whorls is more superficial, giving the first whorls a more regularly conical profile (see Peñas & Rolán, 1997, fig. 222).

Distribution – Lower Pliocene: central Mediterranean, Italy (Chirli & Micali, 2011). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a).

***Eulimella cossignaniorum* Van Aartsen, 1994**
Plate 165, figs 1-2

*1994	*Eulimella cossignanii* [*sic*] Van Aartsen, p. 90, fig. 6.
1996	*Eulimella cossignanii* Van Aartsen, 1994 – Peñas *et al*., p. 34, figs 79, 80, 84.
2001	*Eulimella cossignanii* Van Aartsen, 1994 – Cachia *et al*., p. 95, pl. 15, fig. 6.
2014	*Eulimella cossignaniorum* Van Aartsen, 1994 – Giannuzzi-Savelli *et al*., p. 88, fig. 297, appendix p. 35, 83.

Material and dimensions – Maximum height 2.9 mm, width 910 μm. **EL**: NHMW 2019/0167/0681-0682 (2), NHMW 2019/0167/0683 (2).

Discussion – *Eulimella cossignaniorum* Van Aartsen, 1994 is characterised by its relatively squat, conical shell, type B protoconch (living 225-263 μm; fide Giannuzzi-Savelli *et al*., p. 35, 83), teleoconch of up to eight convex whorls, the early whorls with a cyrtoconoid pupoid profile, later whorls with whorl periphery below mid-whorl, with the abapical portion slightly swollen, separated by a moderately deeply impressed suture. The last whorl is rounded at the base and there is no columellar fold. Growth lines are weakly opisthocline and faint vertical striations are present in some specimens. This species is closely similar to the Mediterranean *E. bogi* Van Aartsen, 1994 in profile and protoocnch type, but differs in having more convex whorls and lacking spiral sculpture, present in *E. bogi*. The name was corrected to *cossignaniorum* as the author stated that it was "*named after T. Cossignani and V. Cossignani*..." (Van Aartsen, 1994, p. 91) (Nofroni & Tringali, 1995, p. 30).

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic: Madeira and Selvagens Islands (Segers *et al*., 2009), western Mediterranean (Van Aartsen, 1994; Peñas *et al*., 1996), central Mediterranean (Van Aartsen, 1994; Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

***Eulimella coysmani* Peñas, Rolán & Swinnen, 2014**
Plate 166, figs 1-4

*2014	*Eulimella coysmani* Peñas, Rolán & Swinnen, p. 182, figs 25I-M.

Material and dimensions – Maximum height 5.4 mm, width 1.7 mm. **VC**: NHMW 2019/0167/0080-0081 (2), NHMW 2019/0167/0221 (25), NHMW 2019/0167/0714-0715 (2). **EL**: NHMW 2019/0167/0850 (1), NHMW 2019/0167/0851 (2). **VS**: NHMW 2019/0167/0862 (2).

Discussion – *Eulimella coysmani* Peñas, Rolán & Swinnen, 2014 is characterised by its small size, regularly conical profile, type A1 tending to B protoconch, the nucleus suture in 'C' form (Estepona specimen; dp = 245-280 μm, dp = 220-230 μm, tilted at angle of 117-120° to main shell axis), teleoconch of about nine whorls, flat-sided adapically, convex just above the suture, separated by a moderately deeply impressed V-shaped suture, without sculpture except for opisthocline growth lines. The last whorl is roundly angled at the periphery, the base is somewhat depressed, imperforate, and the columella straight, without a fold. The protoconch diameter is within the range of that of the holotype from Madeira (280 μm; *fide* Peñas *et al*., 2014, p. 182), although the tilt suggests an A1 tending to B type protoconch as opposed to type B, as stated in the original description. We note that the protoconch angle is not clearly illustrated in the type. Another small difference between the extant material and that from Estepona are the growth lines that are opisthocline in the fossil material.

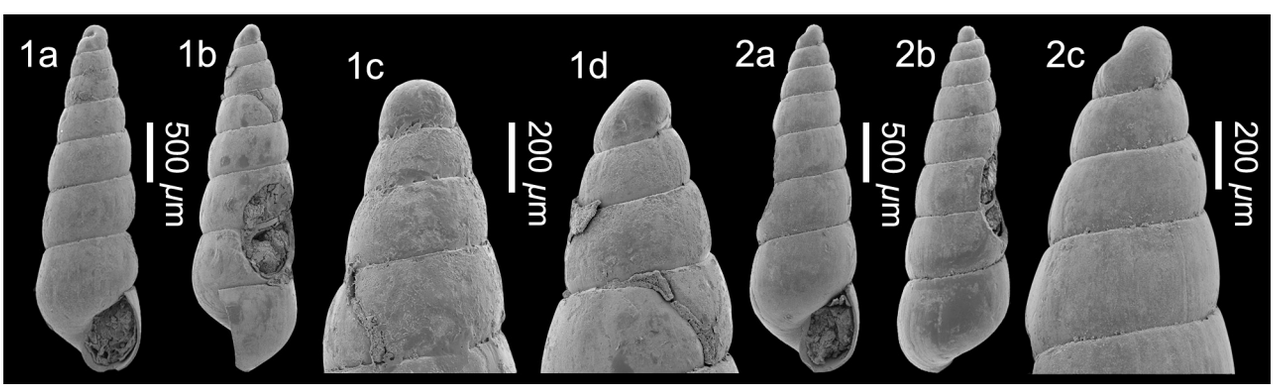

Plate 165. *Eulimella cossignaniorum* Van Aartsen, 1994; 1. NHMW 2019/0167/0681, height 2.9 mm, width 890 μm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0682, height 2.9 mm, width 910 μm, 2c, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

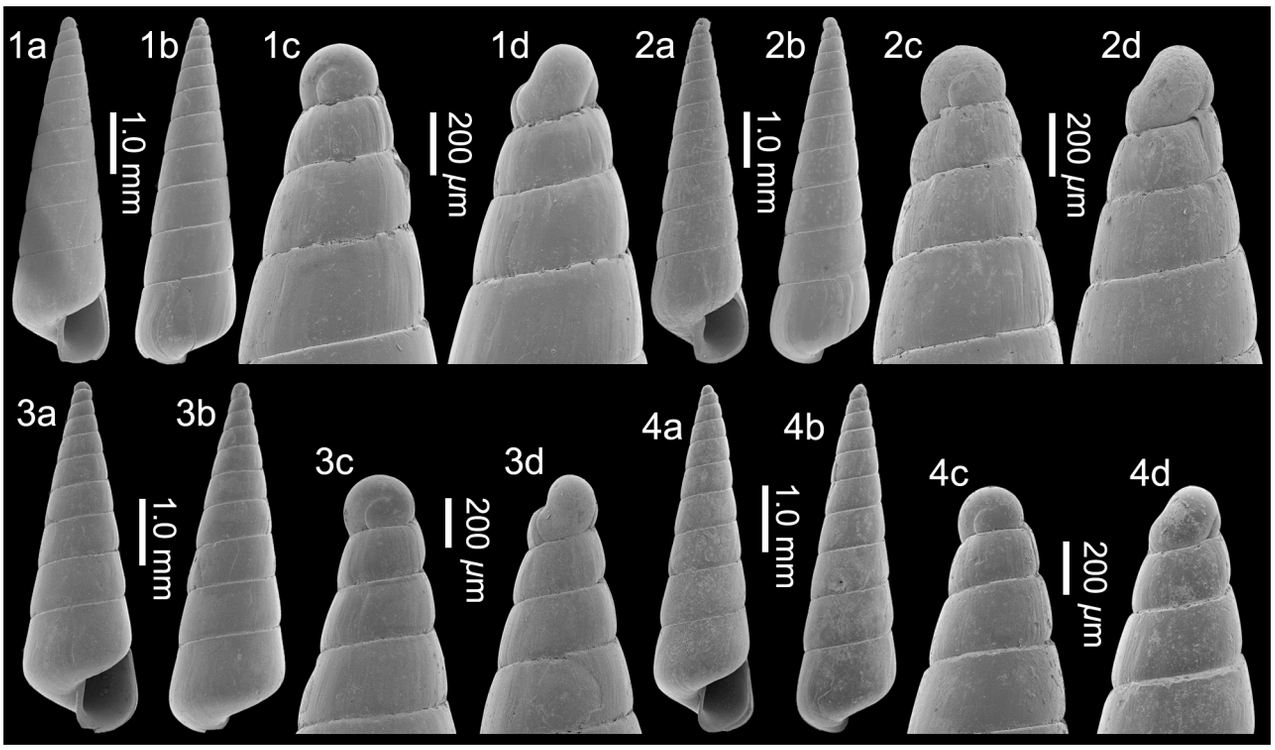

Plate 166. *Eulimella coysmani* Peñas, Rolán & Swinnen, 2014; 1. NHMW 2019/0167/0714, height 5.7 mm, width 1.6 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0715, height 6.4 mm, width 1.7 mm, 2c-d, detail of protoconch; 3. NHMW 2019/0167/0080, height 5.4 mm, width 1.7 mm, 3c-d, detail of protoconch; 4. NHMW 2019/0167/0081, height 5.2 mm, width 1.5 mm, 4c-d, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

In the original description, Peñas *et al*. (2014, p. 182) compared this species to two others that also occur in the Estepona assemblages: *E. scillae*, which differs in being larger, having flat-sided whorls, a shallower suture, opisthocline growth lines, and a Type A protoconch, and *E. angeli* Peñas & Rolán, 1997 that has a narrower profile, opisthocline growth lines, and type A protoconch with a very prominent nucleus.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Madeira, Canary Islands (Peñas *et al*., 2014).

***Eulimella crassitesta* Sorgenfrei, 1958**
Plate 167, figs 1-3

*1958	*Eulimella crassitesta* Sorgenfrei, p. 325, pl. 70, fig. 241.
2010	*Odostomia* (s. lat.) *crassitesta* (Sorgenfrei, 1958) – Moths *et al*., p. 83, pl. 23, fig. 10-11, pl. 45, figs 8-10.

Material and dimensions – Maximum height 2.8 mm, width 805 µm. **VC**: NHMW 2019/0167/0237-0238 (2), NHMW 2019/0167/0498 (1), NHMW 2019/0167/0550 (13).

Discussion – This species is characterised by its minute size, cylindrical shell and type B protoconch. The teleoconch is composed of 4-5 slightly convex whorls, separated by a moderately oblique, weakly impressed, linear suture, and the surface is smooth, except for orthocline growth lines. The columella is very weakly excavated and bears a slightly thickened fold at its adapical end, best seen when the shell is rotated to the left to view within the aperture. It seems to be conspecific with *Eulimella crassitesta* Sorgenfrei, 1958, described from the upper Miocene North Sea Basin. Sorgenfrei's specimen has one whorl less. That author also described the weak fold within the columella. Moths *et al*. (2010, pl. 46, figs 8-10) illustrated a series of specimens from the lower Miocene North Sea Basin of Germany, one of which has five whorls like the Estepona specimen illustrated. Again, the slight columellar thickening can be seen. These scattered stratigraphic records suggest the species is likely to be more widespread geographically and stratigraphically, but has probably been overlooked due to its minute size and relative lack of shell features.
Among the extant species from West Africa, *Eulimella ortizae* Peñas & Rolán, 2000 differs in having fewer and higher whorls, especially the last whorl, and strongly prosocline (instead of orthocline) growth lines.

Distribution – Lower Miocene: North Sea Basin (late Burdigalian-Langhian): Germany (Moths *et al*., 2010). Upper Miocene: North Sea Basin (Tortonian): Denmark (Sorgenfrei, 1958). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

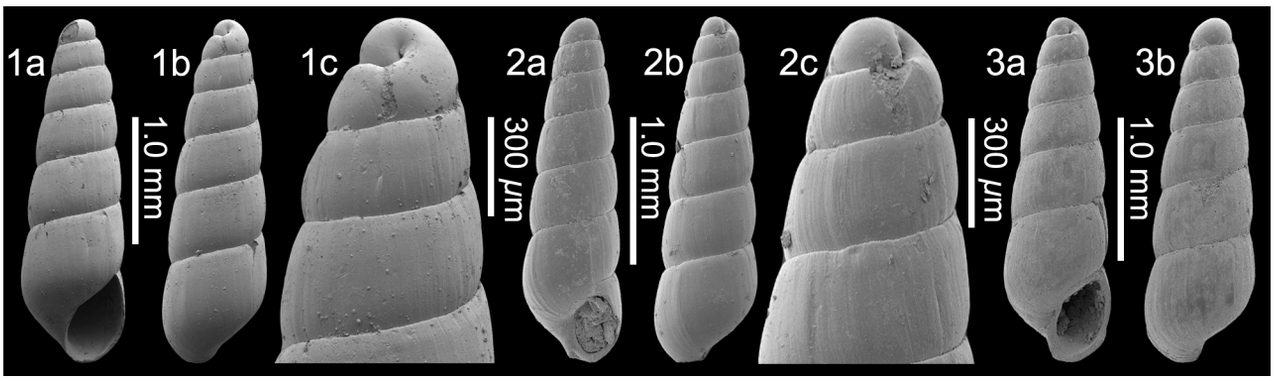

Plate 167. *Eulimella crassitesta* Sorgenfrei, 1958; 1. NHMW 2019/0167/0237, height 2.7 mm, width 830 μm, 1c, detail of protoconch; 2. NHMW 2019/0167/0238, height 2.8 mm, width 805 μm, 2c, detail of protoconch; 3. NHMW 2019/0167/0498, height 2.5 mm, width 730 μm (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Eulimella ignorabilis* Peñas & Rolán, 1997**
Plate 168, fig. 1

*1997	*Eulimella ignorabilis* Peñas & Rolán, p. 92, figs 251-253.
2000	*Eulimella ignorabilis* Peñas & Rolán, 1997 – Van Aartsen *et al*., p. 6, figs 6, 51.
2014	*Eulimella ignorabilis* Peñas & Rolán, 1997 – Peñas *et al*., p. 173, figs 23J-K.
non 2018	*Eulimella ignorabilis* Peñas & Rolán, 1997 – Brunetti & Cresti, p. 108, fig. 465.

Material and dimensions – Height 5.3 mm, width 1.6 mm. **VS**: NHMW 2019/0167/0864 (1).

Discussion – *Eulimella ignorabilis* Peñas & Rolán, 1997 is characterised by slender conical shell with a somewhat telescopic profile, composed of up to eight weakly convex whorls, separated by a moderately impressed strongly oblique suture, and type A1 tending to B protoconch (Estepona specimen; dp = 245 μm, hp = 230 μm; tilted at about 117° to main shell axis). The surface is smooth, except for slightly prosocline growth lines. The last whorl is strongly rounded at the periphery and the base relatively depressed. The aperture is ovate, the columella obique and weakly thickened. The protoconch in the Estepona specimens is smaller than that of extant specimens from Angola (dp = 300-310 μm; *fide* Peñas & Rolán, 1997, p. 92), but as discussed in the material and methods section, we consider protoconch size alone to be insufficient to separate pyramidellid species in most cases.

Eulimella variabilis de Folin, 1870, another present-day West African species that also occurs in the Estepona assemblages, has a similar protoconch, but differs in having flat-sided whorls. The extant European Atlantic and Mediterranean *Eulimella cerullii* (Cossmann, 1915) has a similar outline, but is smaller, with flatter whorls, less deep suture, and a larger protoconch (dp= 300-412 μm; *fide* Giannuzzi Savelli *et al*., 2014, p. 35, 83), less tilted with nucleus fully exposed.

Distribution –Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, southern Spain (this paper). Present-day: Atlantic, West Africa, Mauritania to Angola (Peñas & Rolán, 1997; Van Aartsen *et al*., 2000; Peñas *et al*., 2014).

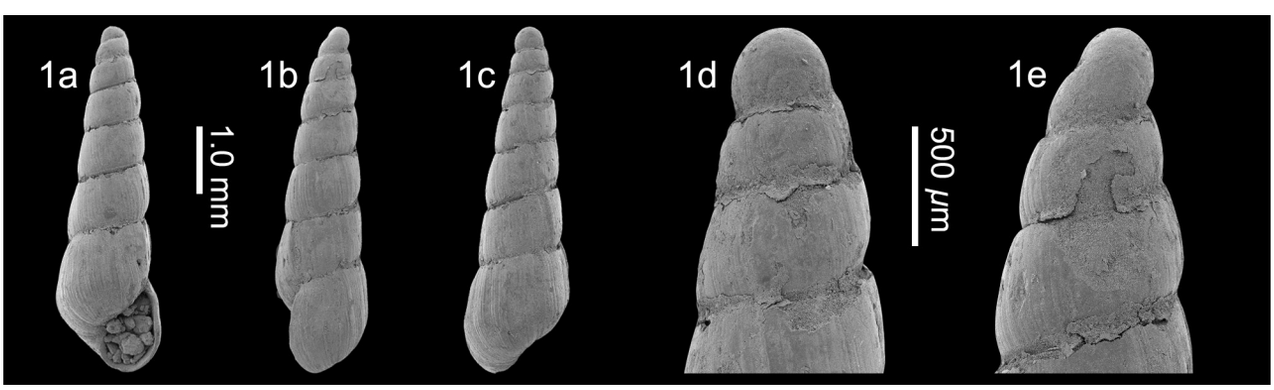

Plate 168. *Eulimella ignorabilis* Peñas & Rolán, 1997; 1. NHMW 2019/0167/0864, height 5.3 mm, width 1.6 mm, 1d-e, detail of protoconch (SEM image). Velerín sands, Velerín, Estepona, lower Piacenzian, upper Pliocene.

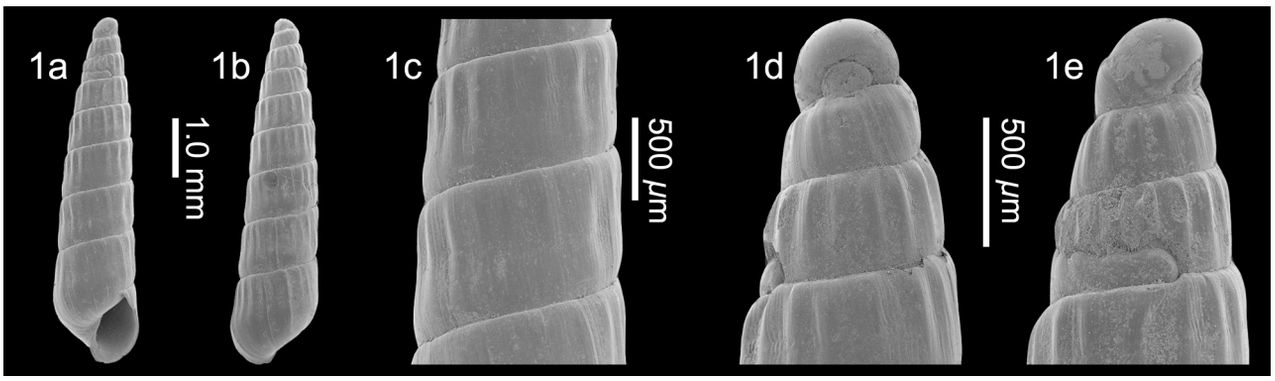

Plate 169. *Eulimella neoattenuata* Gaglini, 1992; 1. NHMW 2019/0167/0531, height 5.9 mm, width 1.5 mm, 1c, detail sculpture last two spire whorls, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Eulimella neoattenuata* Gaglini, 1992**
Plate 169, fig. 1

1875	*Odostomia* (*Eulimella*) *angusta* Monterosato, p. 34 (*nomen nudum*).
1878a	*Odostomia attenuata* Monterosato, p. 94 [*nom. nov. pro Odostomia* (*Eulimella*) *angusta* Monterosato, 1875, *non Turbonilla angusta* Leach, 1852, *non* Gabb, 1873]. Invalid, based on *nomen nudum*.
*1992	*Eulimella neoattenuata* Gaglini, p. 140, 149, fig. 143.
1998	*Eulimella verduini* Van Aartsen, Gittenberger & Goud, p. 43, fig. 47.
1999	*Eulimella neoattenuata* Gaglini, 1992 – Peñas & Rolán, p. 163, figs 29-31.
2013	*Eulimella neoattenuata* Gaglini, 1992 – Öztürk & Bitlis Bakir, p. 427, fig. 7.
2014	*Eulimella neoattenuata* Gaglini, 1992 – Peñas *et al*., p. 173, fig. 24C.
2014	*Eulimella neoattenuata* Gaglini, 1992 – Giannuzzi-Savelli *et al*., p. 88, figs 298, 299, appendix p. 35, 83.

Material and dimensions – Height 5.9 mm, width 1.5 mm. **VC**: NHMW 2019/0167/0531 (1), NHMW 2019/0167/0532 (3).

Discussion – *Eulimella neoattenuata* Gaglini, 1992 is characterised by its tall, slender shell, conical-cylindrical profile, slightly cyrtoconoid and gradate early whorls, type A1 tending to B protoconch of about two whorls, with the nucleus mostly exposed (Estepona specimen; dp = 405 μm, hp = 355 μm, tilted at about 125° to main shell axis), teleoconch of up to eight initially weakly convex, later straight-sided and slightly concave whorls, separated by moderately impressed, linear suture. Unusually for the genus, the whorls are sculptured by low, poorly developed, orthocline to slightly prosocline ribs ("pseudoribs", *fide* Giannuzzi-Savelli *et al*., 2014, appendix pp. 35, 83) that weaken abapically, subobsolete on lower third of spire whorls, separated by interspaces wider than the ribs, axial growth lines are visible in the axial interspaces. The last whorl is about 37% of the total height, straight-sided, rounded at the periphery, the ribs weakening mid-whorl, not extending onto the base, which is smooth and imperforate. The aperture is pyriform, about 19% of the total height, with the columella slightly oblique, without a fold. In the Estepona specimen the protoconch is slightly larger than the measurements given for a specimen from the Mediterranean (dp = 320-340 μm; Giannuzzi-Savelli *et al*., 2014, appendix pp. 35, 83) and the ribs, or pseudoribs are quite strongly developed, similar to the present-day specimen from the Canary Islands illustrated by Van Aartsen *et al*. (1998, fig. 47) as *E. verduini*; considered by Peñas *et al*. 2014, p. 173 a synonym of *E. neoattenuata*.
Giannuzzi-Savelli *et al*. (2014, appendix pp. 35, 83) also considered *E. perangusta* Gaglini, 1992 a synonym of *E. neoattenuata*. The holotype is clearly a juvenile incomplete shell of only four apical whorls with a coeloconoid rather than cyrtoconoid profile, and we therefore exclude it from the synonymy. This species is closely similar to *Tibersyrnola unifasciata* (Forbes, 1844), today widely distributed on both sides of the Atlantic and into the Mediterranean (Peñas *et al*., 2014), but that species has convex teleoconch whorls as opposed to the slightly concave late teleoconch whorls seen in *E. neoattenuata*, a slightly smaller protoconch (dp = 350-375 μm), internal lirae that stops about one-quarter whorl before the aperture (these lirae are visible in specimens lacking final part of aperture, or in transparent fresh shells), and a smooth surface without any axial sculpture.
As far as we are aware, this is the first fossil record for the species.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, Canary Islands (Van Aartsen *et al*., 1998), Azores (Peñas & Rolán, 1999), Madeira and Selvagens Islands (Segers *et al*., 2009), Mauritania (Peñas *et al*., 2014), western Mediterranean (Peñas & Rolán, 1999; Peñas *et al*., 2014), central Mediterranean (Gaglini, 1992; Peñas & Rolán, 1999; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk & Bitlis Bakir, 2013).

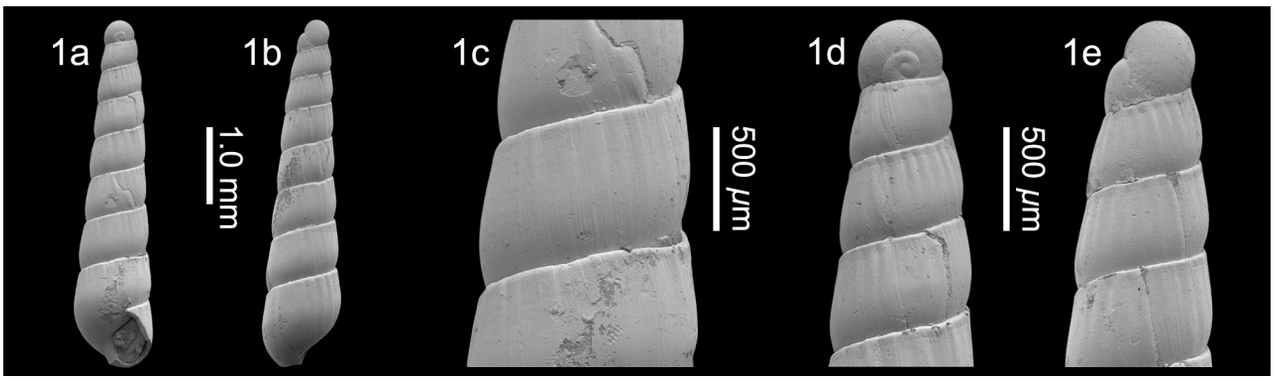

Plate 170. *Eulimella perturbata* Peñas, Rolán & Swinnen, 2014; 1. NHMW 2019/0167/0579, height 4.8 mm, width 1.0 mm, 1c, detail of teleoconch sculpture penultimate whorl, 1d-e, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Eulimella perturbata* Peñas, Rolán & Swinnen, 2014**
Plate 170, fig. 1

1997	*Eulimella monolirata* (de Folin, 1872) – Peñas & Rolán, p. 80, figs 212-215 [*non Eulimella monolirata* (de Folin, 1872)].
2011	*Eulimella monolirata* (de Folin, 1872) – Hernández *et al*., p. 254, figs 88A, B [*non Eulimella monolirata* (de Folin, 1872)].
*2014	*Eulimella perturbata* Peñas, Rolán & Swinnen, p. 179, figs 25D, E.

Material and dimensions – Height 4.8 mm, width 1.0 mm. **VC**: NHMW 2019/0167/0579 (1).

Description – Shell small, very slender, subcylindrical. Protoconch of type A1, of 2.5 whorls, with a small nucleus (Estepona specimen; dp = 410 μm, hp = 370 μm, dn = 50 μm, tilted at about 110° to main shell axis). Teleoconch of seven whorls, straight-sided, later slightly concave adapically, swollen abpically, separated by moderately impressed and oblique, linear suture. Subobsolete axial riblets present on abapical portion of whorls, more strongly developed on early teleoconch whorls, weakening abapically, prosocline. Poorly delimited narrow subsutural band delimited by a couple of fine grooves on early teleoconch whorls, disappearing on later whorls. Last whorl 30% of total height, slightly concave in adapical half, broadly rounded at periphery, base rounded. Aperture incomplete.

Discussion – This single specimen is identified as *Eulimella perturbata* Peñas, Rolán & Swinnen, 2014 from present-day West Africa, even though the protoconch is slightly larger than that of the holotype (dp = 310μm, *fide* Rolán *et al*., 2014). The teleoconch profile is closely similar to that of the West African type, although the fossil specimen is larger, with more numerous whorls. It differs from *E. roeri* (Pavia, 1976), which also occurs in the Estepona assemblages, in having less convex whorls, a poorly developed subsutural cord, weak riblets developed below the suture on early whorls and, above all, a type A1 protoconch as opposed to type A2.
Eulimella monolirata de Folin, 1874 from present-day West Africa is similar in profile, but has a smaller type A1 protoconch (dp = 265-316 μm; *fide* Peñas & Rolán, 1997, p. 80), the subsutural cord is more strongly developed and it lacks the axial sculpture seen in *E. perturbata*. *Eulimella polygyrata* Dautzenberg, 1912, also from present-day West Africa, has an A1 type protoconch of slightly smaller size (dp = 350 μm; *fide* Peñas & Rolán, 1997, p. 82), but differs in having much more convex whorls and again lacks spiral sculpture. *Eulimella acusangusta* Peñas & Rolán, 1997, also from West Africa is very similar in profile and also has an A1 type protoconch (dp = 350 μm; *fide* Peñas & Rolán, 1997, p. 82), but again lacks axial sculpture. Although the protoconch of all these West African species is of type A1, it is less submerged into the first teleoconch whorl as it is in *E. perturbata*.
This record adds to the group of present-day West African species that in the warm Pliocene extended their range northwards to the western Mediterranean.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic West Africa, Mauritania to Príncipe Islands (Rolán *et al*., 2014).

***Eulimella postsubcylindrica* Sacco, 1892**
Plate 171, figs 1-4

*1892a	*Eulimella acicula* var. *postsubcylindrica* Sacco, p. 53, pl. 2, fig. 12.
2011	*Eulimella postsubcylindrica* Sacco, 1892 – Chirli & Linse, p. 199, pl. 76, fig. 1.
non 2011	*Eulimella postsubcylindrica* Sacco, 1892 – Chirli & Micali, p. 12, pl. 3, figs 4, 5 (*Eulimella exsubulata* Sacco, 1892).

Material and dimensions – Maximum height 8.0 mm, width 1.6 mm. **CO**: NHMW 2019/0167/0262 (1). **VC**:

NHMW 2019/0167/0219-0220 (2), NHMW 2019/0167/0496 (8), NHMW 2019/0167/0541 (1), NHMW 2019/0167/0711-0713 (3). **VS**: NHMW 2019/0167/0861 (2).

Discussion – *Eulimella postsubcylindrica* Sacco, 1892 is characterised by its very tall, slender profile, type A2 protoconch (Estepona specimen; dp = 305 μm, hp = 240-260 μm, tilted at about 122° to main shell axis), teleoconch composed of up to 11 whorls, early whorls convex, later whorls somewhat fustate, swollen in the abapical half above the suture, separated by a moderately impressed suture. Growth lines are opisthocline and sinuous, with the occasional one weakly varicose, marking previous positions of the outer lip. The aperture is pyriform, the outer lip sinuous in profile, and the columella almost straight bearing a very weak fold at its adapical end. This species was originally described as a subspecies of *E. acicula* (Philippi, 1836), from which it differs in having a larger protoconch (of the same type), but much more compact, and having somewhat frustate whorls.
The specimen figured by Chirli & Micali (2011, pl. 3, figs 4, 5) is not this species, but probably conspecific with *Turbonilla subulata sensu* Speyer, 1870 (pl. 25, figs 17-20; mainly fig. 19), that Sacco (1892a, p. 53) renamed *Eulimella exsubulata*. It differs from *E. postsubcylindrica* in having a type A1 protoconch and prosocline rather than opisthocline growth lines.

Distribution –Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a); eastern Mediterranean, Rhodes (Chirli & Linse, 2011). Lower Pleistocene: eastern Mediterranean, Rhodes (Chirli & Linse, 2011).

***Eulimella pseudoanisocycloides* Sacco, 1892**
Plate 172, fig. 1

*1892a	*Eulimella*? *pseudoanisocycloides* Sacco, p. 56, pl. 2, fig. 24.
1984	*Eulimella*? *pseudoanisocycloides* Sacco, 1892 – Ferrero Mortara *et al*., p. 77, pl. 11, fig. 13.
non 1969	*Eulimella pseudanisocycloides* [*sic*] Sacco – Fekih, p. 52, pl. 11, fig. 2.

Material and dimensions – Maximum height 4.1 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0161 (1), NHMW 2019/0167/0162 (1).

Discussion – *Eulimella pseudoanisocycloides* Sacco, 1892 is characterised by its tall, slender, conical shell, type A2 protoconch of just under 2.5 whorls, with a large nucleus (dp = 270 μm, dn = 100 μm), teleoconch of up to seven strongly convex whorls separated by a moderately impressed, linear suture, smooth except for weakly prosocline growth lines, and an evenly rounded last whorl, with the base not delimited. The specimen from Estepona is identical to the apical fragment of the holotype illustrated by Ferrero Mortara *et al*. (1984, p. 77, pl.

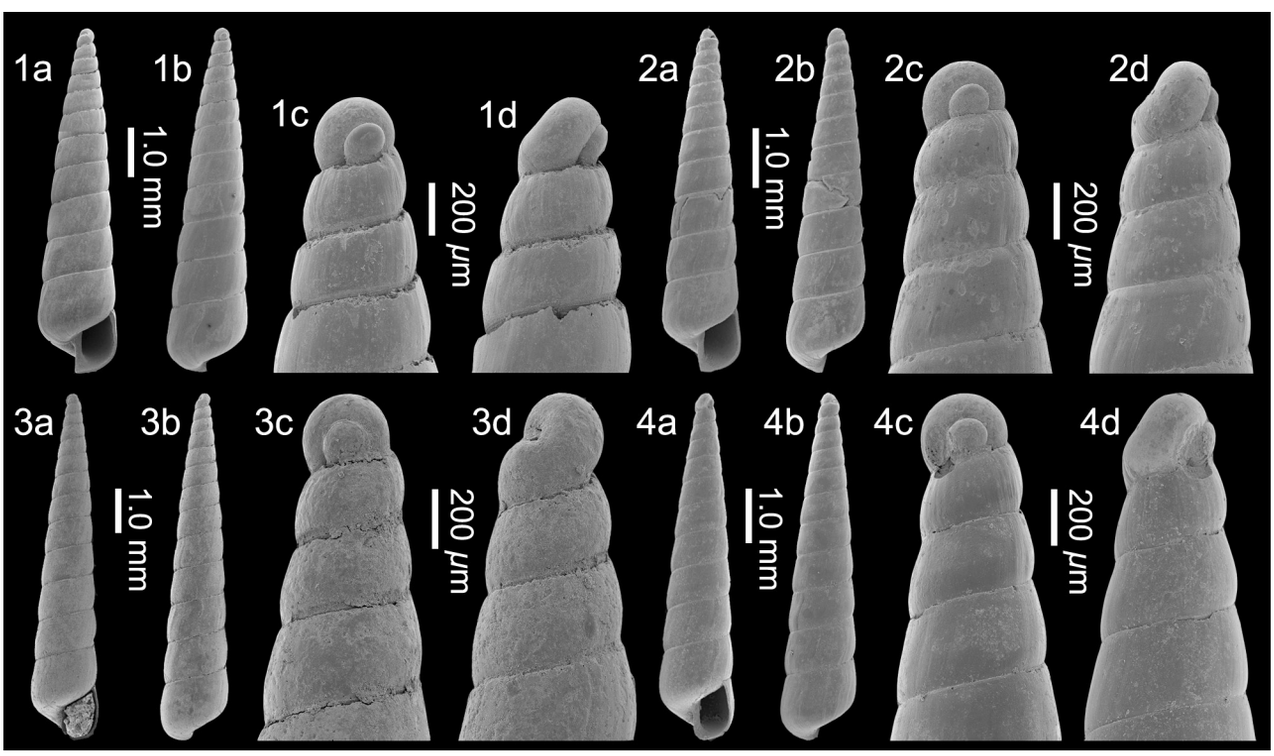

Plate 171. *Eulimella postsubcylindrica* Sacco, 1892; 1. NHMW 2019/0167/0219, height 7.1 mm, width 1.6 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0541, height 5.9 mm, width 1.2 mm, 2c-d, detail of protoconch; 3. NHMW 2019/0167/0711, height 8.0 mm, width 1.5 mm, 1c-d, detail of protoconch; 4. NHMW 2019/0167/0712, height 6.5 mm, width 1.4 mm, 2c-d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

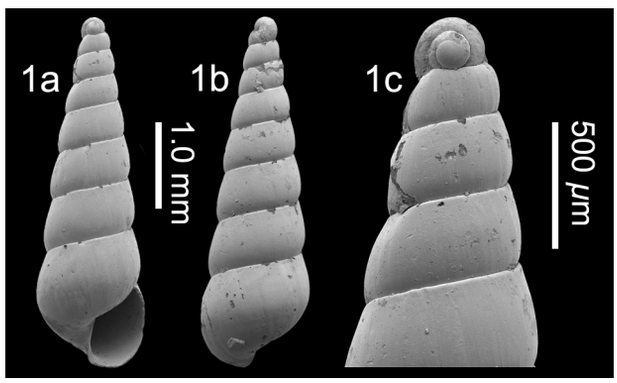

Plate 172. *Eulimella pseudoanisocycloides* Sacco, 1892; 1. NHMW 2019/0167/0161, height 4.1 mm, width 1.2 mm, 1c, detail of protoconch (SEM image). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

11, fig. 13). The last whorl is slightly more rounded than in the apertural fragment of the holotype, which has been broken at some stage.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a).

***Eulimella scalarioinflata* Sacco, 1892**
Plate 173, figs 1-2; Plate 174, fig. 2

*1892a	*Eulimella Scillae* var. *scalarioinflata*	Sacco, p. 51, pl. 2, fig. 4.
1984	*Eulimella scillae* var. *scalarioinflata*	Sacco, 1892 – Ferrero Mortara *et al*., p. 75, pl. 11, fig. 2.
1992	*Eulimella scillae*	(Scacchi, 1835) – Cavallo & Repetto, p. 156, fig. 437 [*non E. scillae* (Scacchi, 1835)].
2008	*Eulimella scillae*	(Scacchi, 1835) – Chirli & Richard, p. 76, pl. 15, fig. 3 [*non E. scillae* (Scacchi, 1835)].

Material and dimensions – Maximum height 5.5 mm, width 1.6 mm. **VC**: NHMW 2019/0167/0598 (1), NHMW 2019/0167/0599 (20), NHMW 2019/0167/0715(1). **EL**: NHMW 2019/0167/0659 (1)

Discussion – This species is characterised by its tall slender shell, with regularly conical spire, type A2 protoconch of 2.25 whorls, with the nucleus almost completely exposed (Estepona specimen; dp = 285 μm, hp = 260 μm, dn = 130 µm, tilted at angle of 110° to main shell axis), teleoconch of up to 10 rather low, almost straight-sided whorls, very slightly swollen just above the suture forming the periphery. The suture is linear, not strongly oblique and weakly impressed, growth lines opisthocline and flexuous. The last whorl is broad, strongly rounded at the periphery, with the base depressed. The aperture is subquadrate, with a short, vertical, thickened columella.
Sacco (1892a) stated that var. *scalarioinflata* differs from *E. scillae* in "*Anfractus superne subdepressi, in regione ventrali infera inflatellati, deinde testa subscalarata* [whorls restricted at adapical suture and swollen at abapical suture, giving to the shell a scalate outline]" (1892a, p. 51). *Eulimella scalarioinflata* Sacco, 1892 can easily be separated from *E. scillae* (Scacchi, 1835) based on its narower spire angle and whorl profile; flat-sided in *E. scillae*. Moreover, in all samples examined there are no intermediate specimens (PM personal observation).

Distribution – Middle Miocene: western Proto-Mediterranean, NE Spain (Moreno *et al*., 2003). Upper Miocene: western Mediterranean, Roussillon Basin, France (Chirli & Richard, 2008); central Proto-Mediterranean, Italy (Sacco, 1892a). Lower Pliocene: central Mediterranean, Italy (Sacco, 1892a). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Eulimella scillae* (Scacchi, 1835)**
Plate 174, fig. 1 (only)

*1835	*Melania Scillae*	Scacchi, p. 51.
1839	*Eulima crassula*	Jeffreys, p. 34 (*nomen nudum*).
1844	*Eulima macandrei*	Forbes, p. 412.

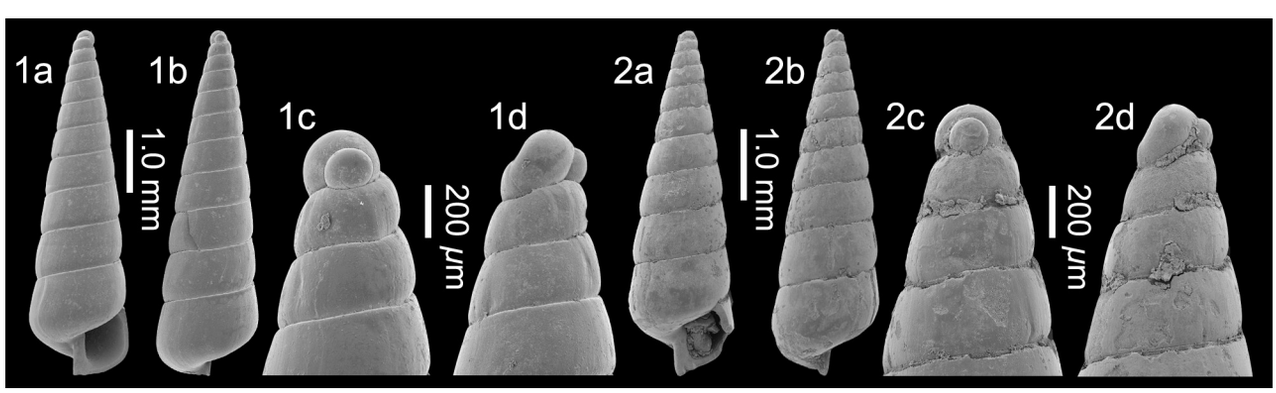

Plate 173. *Eulimella scalarioinflata* Sacco, 1892; 1. NHMW 2019/0167/0598, height 5.5 mm, width 1.6 mm, 1c-d, detail of protoconch. Velerín carretera, Velerín. 2. NHMW 2019/0167/0659, height 4.9 mm, width 1.5 mm, 2c-d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

1844 *Eulimella Scillae* Scacchi – Philippi, p. 135, pl. 24, fig. 6.
1892a *Eulimella Scillae* Scacch. – Sacco, p. 50, pl. 2, fig. 1.
1892a *Eulimella Scillae* var. *anteconica* Sacco, p. 50, pl. 2, fig. 2.
1892a *Eulimella Scillae* var. *graciliturrita* Sacco, p. 50, pl. 2, fig. 3.
1914 *Eulimella Scillae* Scacchi – Cerulli-Irelli, p. 256 [430], pl. 22 [54], figs 46-50.
1946 *Eulimella* (*Eulimella*) *scillae* (Scacchi, 1835) – Beets, p. 52, pl. 3, fig. 10.
1956 *Eulimella* (*Eulimella*) *scillae* (Scacchi 1836) – Rasmussen, p. 100, pl. 10, fig. 2.
1964 *Eulimella scillae* Scacchi, 1835 – Brébion, p. 291, pl. 7, figs 15-17.
1969 *Eulimella scillae* Scacchi – Fekih, p. 48, pl. 10, figs 1, 2.
1986 *Eulimella scillae* (Scacchi, 1835) – Fretter *et al*., p. 624, figs 434, 435.
1988 *Eulimella scillae* (Scacchi, 1835) – Graham, p. 612, fig. 267.
1994 *Eulimella scillae* (Scacchi, 1835) – Van Aartsen, p. 96, fig. 17.
1996 *Eulimella scillae* (Scacchi, 1835) – Peñas *et al*., p. 34, figs 66-68.
2000 *Eulimella scillae* (Scacchi, 1835) – Van Aartsen *et al*., p. 3, figs 1, 2.
2001 *Eulimella scillae* (Scacchi, 1835) – Cachia *et al*., p. 95, pl. 15, fig. 7.
2005 *Eulimella scillae* (Scacchi, 1835) – Rolán, p. 199, fig. 912.
?2005 *Eulimella* (*Eulimella*) *scillae* (Scacchi, 1836 [sic]) – Schnetler, p. 121, pl. 9, fig. 5 (in plate caption and text quoted as fig. 6; ? *lapsus* figures 5 and 6 inverted).
2011 *Eulimella scillae* (Scacchi, 1835) – Chirli & Micali, p. 14, pl. 4, figs 1-8.
2011 *Eulimella scillae* (Scacchi, 1835) – Chirli & Linse, p. 200, pl. 76, fig. 2.
2011 *Eulimella scillae* (Scacchi, 1835) – Landau *et al*., p. 42, pl. 23, fig. 5.
2011 *Eulimella scillae* (Scacchi, 1835) – Hernández *et al*., p. 255, figs 88D.
2013 *Eulimella scillae* (Scacchi, 1835) – Landau *et al*., p. 318, pl. 76, figs 3, 4.
2013 *Eulimella scillae* (Scacchi, 1835) – Öztürk & Bitlis Bakir, p. 427, fig 8A-D.
2014 *Eulimella scillae* (Scacchi, 1835) – Høisæter, p. 59, figs 99-100.
2014 *Eulimella scillae* (Scacchi, 1835) – Giannuzzi-Savelli *et al*., p. 90, fig. 305, appendix p. 36, 83.
2018 *Eulimella scillae* (Scacchi, 1835) – Ceulemans *et al*., 318, pl. 76, figs 3, 4.
2018 *Eulimella scillae* (Scacchi, 1835) – Brunetti & Cresti, p. 108, fig. 467.

non 1921 *Eulimella Scillai* [*sic*] Scacchi – Cossmann, p. 301, pl. 6, figs 17, 18.
non 1958 *Eulimella Scillae* Scacchi – Sorgenfrei, p. 322, pl. 69, fig. 239.
non 1991 *Eulimella scillae* (Scacchi, 1835) – Warén, p. 110, Figs 37A, 38C [= ?*Eulimella compactilis* (Jeffreys, 1867)].
non 2007 *Eulimella* (*Eulimella*) *scillae* (Scacchi, 1836 [*sic*]) – Wienrich, p. 743, pl. 123, fig. 4, pl. 160, fig. 8, pl. 161, fig. 3.

Material and dimensions – Maximum height 9.7 mm, width 2.8 mm. **VC**: NHMW 2019/0167/0714 (1), NHMW 2019/0167/0716 (15). **VS**: NHMW 2019/0167/0863 (2). **EL**: NHMW 2019/0167/0729 (2).

Discussion – This species is characterised by its regularly conical spire, type A2 protoconch of 2.25 whorls, with the nucleus almost completely exposed (Estepona specimen; dp = 280-320 μm, hp = 270-290 μm, dn = 110-130 μm, tilted at angle of 108-112° to main shell axis) and teleoconch of up to 12 rather low, flat-sided whorls, The suture is linear, not strongly oblique and weakly impressed. Growth lines are opisthocline and flexuous. The last whorl is broad, strongly rounded at the low-placed periphery, and the base is strongly depressed. The aperture is subquadrate, with a short, vertical, thickened columella.

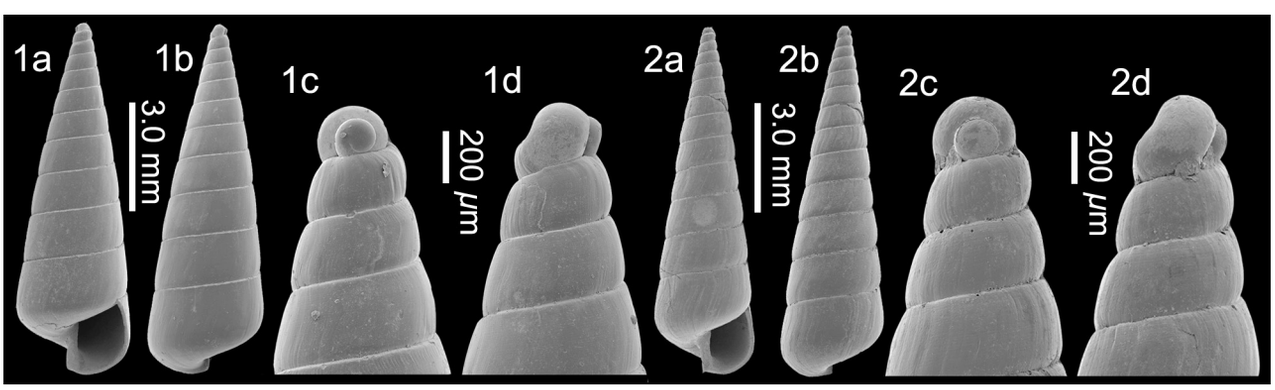

Plate 174. *Eulimella scillae* (Scacchi, 1835); 1. NHMW 2019/0167/0714, height 9.7 mm, width 2.8 mm, 1c-d, detail of protoconch. *Eulimella scalarioinflata* Sacco, 1892; 2. NHMW 2019/0167/0715, height 9.6 mm, width 3.1 mm, 2c-d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene. *Eulimella scillae* and *E. scalarioinflata* placed together for comparison.

Eulimella coysmani Peñas, Rolán & Swinnen, 2014, with which it co-occurs in the Estepona assemblages, is smaller, with a narrower spire angle, and a type A1 protoconch composed of fewer whorls. *Eulimella scalarioinflata* Sacco, 1892, also found in Estepona, has a similar A2 type protoconch, but a narrower spire angle, weakly convex instead of flat-sided whorls, and the base is less depressed (compare Pl. 174 fig. 1. *E. scillae* vs fig. 2. *E. scalarioinflata*).

Distribution – Middle Miocene: Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: North Sea Basin (Tortonian): Denmark (Rasmussen, 1956; ?Schnetler, 2005); Proto-Mediterranean Sea (Tortonian): Po Basin (Sacco, 1892a). Lower Pliocene: Atlantic, northwestern France (Ceulemans *et al*., 2018; Brébion, 1964), Guadalquivir Basin, Spain (Landau *et al*., 2011), Roussillon Basin, France (Chirli & Richard, 2008); central Mediterranean, Italy (Sacco, 1892a; Chirli & Micali, 2011; Brunetti & Cresti, 2018), Tunisia (Fekih, 1969). Upper Pliocene: North Sea Basin, Netherlands (Beets, 1946), Mondego Basin, Portugal (NHMW collection; NHMW 2018/0331/0295); western Mediterranean, Estepona Basin (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Micali & Villari, 1989), Rhodes Island (Chirli & Linse, 2011). Present-day: Atlantic, Norway (Høisæter, 2014), British Isles (Fretter *et al*., 1986; Graham, 1988), south to Canary Islands (Hernández *et al*., 2011), Mauritania (Van Aartsen *et al*., 2000), Cape Verde Islands (Rolán, 2005), Azores, Madeira, Canary and Cape Verde Islands, West Africa (Rolán, 2005), western Mediterranean (Peñas *et al*., 1996), central Mediterranean (Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean (Öztürk &Bitlis Bakir, 2013).

Eulimella trewae Van Aartsen, Gittenberger & Goud, 2000

Plate 175, figs 1-3

*2000 *Eulimella trewae* Van Aartsen, Gittenberger & Goud, p. 4, fig. 3.

Material and dimensions – Height 6.0 mm, width 1.9 mm. **CO**: NHMW 2019/0167/0828 (1). **EL**: NHMW 2019/0167/0673 (1), NHMW 2019/0167/0694-0695 (2), NHMW 2019/0167/0696 (2).

Discussion – *Eulimella trewae* Van Aartsen, Gittenberger & Goud, 2000 is an extremely distinctive species that cannot be confused with any of its Estepona congeners. It is characterised by its slender conical shape, type A2 helicoid protoconch of 2.25 whorls, with a medium-sized nucleus (Estepona specimen: dp = 27-280 μm, hp = 280-300 μm, dn = 95 μm, tilted at angle of 110° to main shell axis). The largest specimen from Estepona has ten weakly convex to flat-sided teleoconch whorls,

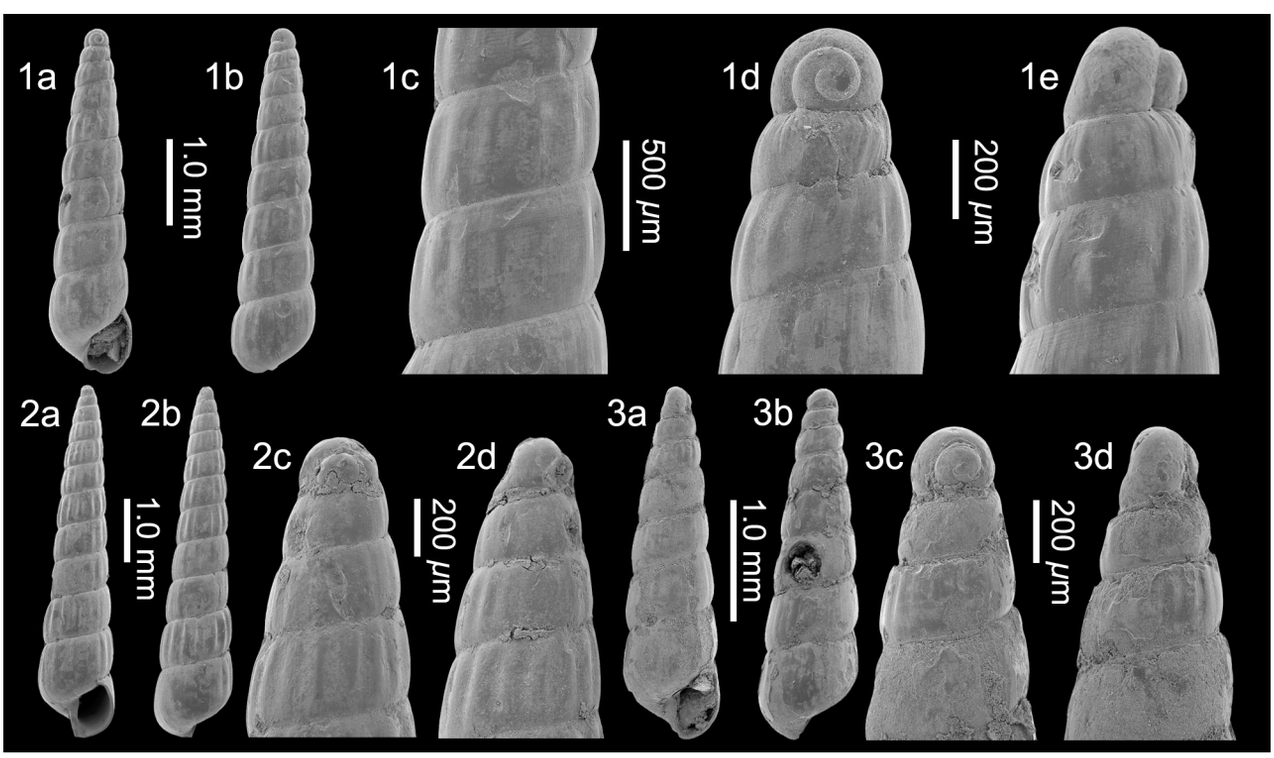

Plate 175. *Eulimella trewae* Van Aartsen, Gittenberger & Goud, 2000; 1. NHMW 2019/0167/0673, height 4.0 mm, width 940 μm, 1c, detail of sculpture last two spire whorls, 1d-e, detail of protoconch; 2. NHMW 2019/0167/0694, height 5.4 mm, width 1.2 mm, 2c-d, detail of protoconch; 3. NHMW 2019/0167/0695, height 2.9 mm, width 795 μm, 3c-d, detail of protoconch (SEM images). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

sculptured by broad, flattened ribs, about 12 on penultimate whorl, slightly narrower than their interspaces, extremely fine spiral sculpture (Pl. 175, fig. 1c-e), and orthocline growth lines. The aperture is small, ovate, the columella vertical, thickened, with an indistinct fold at its adapical end. *Eulimella neoattenuata* Gaglini, 1992 (see above) differs in having a slightly concave whorl profile and type A1 tending to B planorbid protoconch. *Eulimella perturbata* Peñas, Rolán & Swinnen, 2014 from present-day West Africa differs for the whorl profile, the type A1 planorbid protoconch and the much more impressed suture.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Mauritania (Van Aartsen *et al*., 2000).

***Eulimella variabilis* de Folin, 1870**
Plate 176, fig. 1

*1870	*Eulimella variabilis* de Folin *in* de Folin & Périer, p. 211, pl. 28, fig. 12.
1912	*Eulimella chasteri* Dautzenberg, p. 63, pl. 2, figs 20, 21.
1994	*Eulimella variabilis* De Folin, 1870 – Schander, p. 32, figs 2b, 11d.
1997	*Eulimella variabilis* De Folin, 1870 – Peñas & Rolán, p. 90, figs 249, 250, 260, 261.

Material and dimensions – Height 4.1 mm, width 1.2 mm. **VC**: NHMW 2019/0167/0866 (7). **PA**: NHMW 2019/0167/0723 (1).

Discussion – *Eulimella variabilis* De Folin, 1870 is characterised by its slender conical shell and type B protoconch (Estepona specimen: dp = 275 μm, hp = 250 μm; tilted at angle of 122° to main shell axis), slightly smaller than for extant specimens (dp = 295-300 μm, *fide* Peñas & Rolán, 1997; dp = 320 μm, *fide* Schander, 1994). The early teleoconch whorls are slightly convex, abapically becoming straight-sided, very slightly swollen just above the weakly impressed suture. The last whorl is broadly rounded at the base, the columella vertical, with a weak fold at the adapical end. *Eulimella variabilis* differs from *E. cossignaniorum* Van Aartsen, 1994 (see above) in being larger, with less convex and higher whorls.

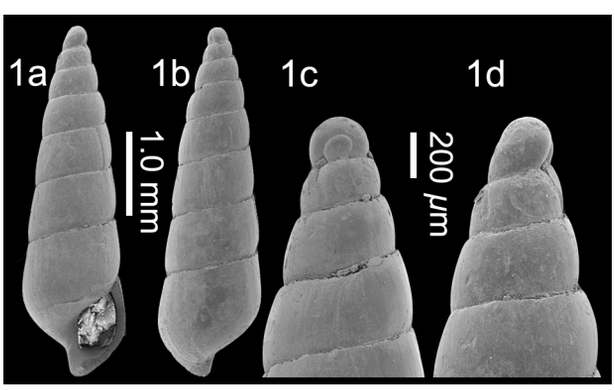

Plate 176. *Eulimella variabilis* De Folin, 1870; 1. NHMW 2019/0167/0723, height 4.1 mm, width 1.2 mm, 1c-d, detail of protoconch (SEM image). Rio del Padrón, Estepona, lower Piacenzian, upper Pliocene.

Distribution – Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, West Africa, Senegal (de Folin, 1870) to Angola (Peñas & Rolán, 1997).

***Eulimella ventricosa* (Forbes, 1844)**
Plate 177, figs 1-2

*1844	*Parthenia ventricosa* Forbes, p. 188.
1847	*Eulimella gracilis* Jeffreys, p. 311.
1850	*Eulimella affinis* Forbes & Hanley, p. 313.
1858	*Eulimella obeliscus* Jeffreys, p. 46.
1981	*Eulimella* (*E.*) *ventricosa* (Forbes) – Caldara *et al*., p. 151, pl. 2, fig. 3.
1984	*Eulimella ventricosa* (Forbes, 1844) – Van Aartsen *et al*., p. 50, fig. 242.
1986	*Eulimella ventricosa* (Forbes, 1843 [*sic*]) – Fretter *et al*., p. 627, figs 437, 438.
1988	*Eulimella ventricosa* (Forbes, 1843 [*sic*]) – Graham, p. 616, fig. 269.
1991	*Eulimella ventricosa* (Forbes, 1844) – Warén, p. 111, figs 37C-D, 38D.
1996	*Eulimella ventricosa* (Forbes, 1844) – Peñas *et al*., p. 36, figs 72-73, 77.
2001	*Eulimella ventricosa* (Forbes, 1844) – Cachia *et al*., p. 96, pl. 15, fig. 9.
2005	*Eulimella ventricosa* (Forbes, 1844) – Rolán, p. 199, figs 910, 911.
2011	*Eulimella ventricosa* (Forbes, 1844) – Hernández *et al*., p. 256, fig. 88M.
2013	*Eulimella ventricosa* (Forbes, 1844) – Öztürk & Bitlis Bakir, p. 428, fig. 9.
2014	*Eulimella ventricosa* (Forbes, 1844) – Høisaeter, p. 60, figs 96, 101-102.
2014	*Eulimella ventricosa* (Forbes, 1844) – Giannuzzi-Savelli *et al*., p. 88, figs 301-304, appendix p. 36, 83.
2014	*Eulimella ventricosa* (Forbes, 1844) – Peñas *et al*., p. 178, figs 24M-N.
2018	*Eulimella ventricosa* (Forbes, 1844) – Brunetti & Cresti, p. 108, fig. 469.
2020	*Eulimella ventricosa* (Forbes, 1844) – Landau *et al*., p. 343, pl. 73, fig. 1.

Material and dimensions – Maximum height 6.0 mm, width 1.6 mm. **VC**: NHMW 2019/0167/0163-0164 (2), NHMW 2019/0167/0495 (11).

Discussion – *Eulimella ventricosa* (Forbes, 1844) is characterised by its type B protoconch (Estepona specimen; dp = 260 μm, hp = 210-230 μm, tilted at angle of 135° to main shell axis), and teleoconch composed of up to ten

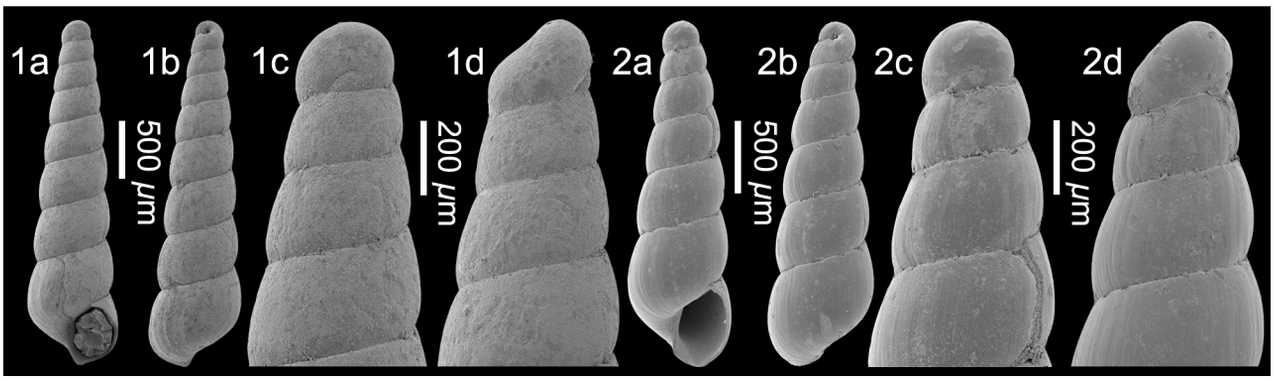

Plate 177. *Eulimella ventricosa* (Forbes, 1844); 1. NHMW 2019/0167/0163, height 6.0 mm, width 1.6 mm, 1c-d, detail of protoconch; 2. NHMW 2019/0167/0164, height 4.7 mm, width 1.4 mm, 2c-d, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

strongly and regularly convex whorls, smooth, with fine prosocline growth lines, separated by a deeply impressed suture. The protoconch size is almost identical to that of the specimen illustrated by Peñas *et al*. (1996, fig. 77; dp = 255 μm) from the Islas Columbretes, off eastern Spain and Warén (1991, fig. 38D; dp = 250 μm) from western Norway, although Warén noted that the Norwegian specimens had a protoconch about 10% smaller than the Mediterranean populations. The protoconch is more strongly tilted in the Estepona specimens, type B, rather than type A tending to B seen in illustrations of extant specimens (Fretter *et al*., 1986, fig. 438; Peñas *et al*., 2014, fig. 24N) and in upper Miocene specimens from northwestern France (Landau *et al*., 2020, pl. 73, fig. 1c). Another small difference is that the growth lines in the Estepona specimens are slightly more sinuous than usual for the species, but we consider these small differences insufficient to separate them. *Eulimella ataktos* Warén, 1991 described from Norway, but subsequently recognised also in the Mediterranean (Peñas *et al*., 1996) is closely similar, but has a protoconch closer to A2, slightly broader whorls, and the columella is straighter.

Distribution – Upper Miocene: Atlantic (Tortonian): NW France (Landau *et al*., 2020). Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992b; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: central Mediterranean, Italy (Seguenza, 1876; Caldara *et al*., 1981; Di Geronimo *et al*., 1982: Micali & Vilari, 1986; Di Geronimo & La Perna, 1997; Gianolla *et al*., 2010; Brunetti, 2011). Present-day: Eastern Atlantic from Norway (Warén, 1991; Høisaeter, 2014), Shetlands (Fretter *et al*., 1986; Graham, 1988) to Canary Islands (Van Aartsen *et al*., 2000; Hernández *et al*., 2011), Madeira and Selvagens Islands (Segers *et al*., 2009), Cape Verde Islands (Peñas & Rolán, 1997; Rolán, 2005), to Guinea-Bissau (Peñas *et al*., 2014), western Mediterranean (Van Aartsen *et al*., 1984; Peñas & Rolán, 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014), eastern Mediterranean, Turkey (Öztürk & Bitlis Bakir, 2013).

***Eulimella* sp. 1**
Plate 178, fig. 1

1914 *Eulimella affinis* Phil. – Cerulli-Irelli, p. 257 [431], pl. 22 [54], figs 51-55 [*non Eulima affinis* Philippi, 1844; = ?*E. acicula* (Philippi, 1836)].
?2018 *Eulimella* sp. B – Brunetti & Cresti, p. 108, fig. 471.

Material and dimensions – Height 4.7 mm, width 1.3 mm. **CO**: NHMW 2019/0167/0497 (1).

Discussion – This species is characterised by its solid shell, narrow cyrtoconoid conical to subcylindrical profile, small type A2 helicoid protoconch (dp = 235 μm, hp = 220 μm), teleoconch composed of eight flat-convex whorls, separated by a moderately impressed suture, straight, orthocline growth lines, last whorl rounded at the base, imperforate, aperture small, and columella without a fold. It seems to be the same species illustrated by Cerulli-Irelli (1914, pl. pl. 22, figs 51-55) as *Eulimella affinis* Phil. from the lower Pleistocene of Italy. Philippi's species is based on a fossil from the Pleistocene near Palermo (Italy) and the original drawing (1844, p. 135,

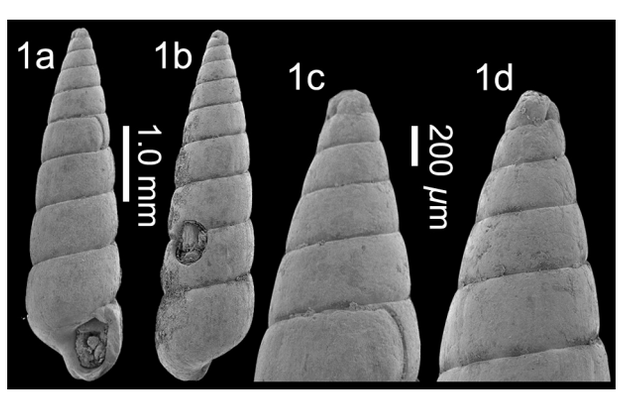

Plate 178. *Eulimella* sp. 1; 1. NHMW 2019/0167/0497, height 4.7 mm, width 1.3 mm, 1c-d, detail of protoconch (SEM image). Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

pl. 24, fig. 7) shows a shell with a slender outline and deep suture that does not correspond with Cerulli Irelli's material. It is also closely similar to the Italian Pliocene species illustrated by Brunetti & Cresti (2018, fig. 471) as *Eulimella* sp. B., but that species has a slightly frustate profile.

In the extant faunas, it is closely similar in teleoconch characters to *E. troncosoi* Peñas, Rolán & Swinnen, 2014, a deep-water species from Madeira and the Canary Islands, which shows a similar profile, but a type B protoconch. However, with the scant material available, we cannot comment on the intraspecific variability in the Estepona population, and we await further material to better characterise this species.

Distribution – ?Lower Pliocene: central Mediterranean, Italy (Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

***Eulimella* sp. 2**
Plate 179, fig. 1

Material and dimensions – Height 4.3 mm, width 1.1 mm. **EL**: NHMW 2019/0167/0648 (1).

Discussion – This species is characterised by its solid shell, narrow conical profile, small type B protoconch (dp = 240 μm, tilted at angle of 130° to main shell axis), teleoconch composed of eight convex whorls, separated by a moderately deeply impressed suture, straight, opisthocline growth lines, last whorl rounded at the base, imperforate, aperture small, and columella without a fold. It differs from *E. postsubcylidrica* Sacco, 1892 in having a smaller protoconch (240 μm vs 305 μm), more inclined, with less protruding nucleus, opisthocline growth lines that are not sinuous, and a more rounded periphery. This could represent an undescribed species, but with only one specimen available we hesitate to erect a new species.

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

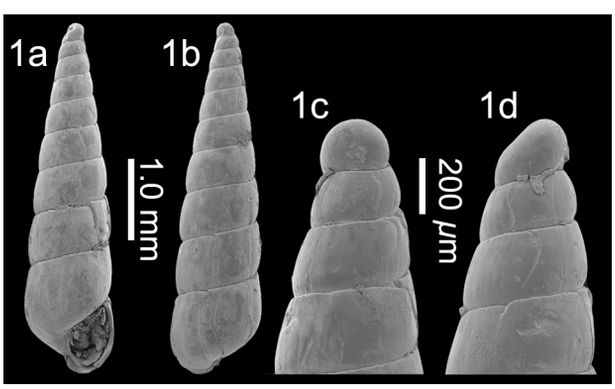

Plate 179. *Eulimella* sp. 2; 1. NHMW 2019/0167/0648, height 4.3 mm, width 1.1 mm, 1c-d, detail of protoconch (SEM image). El Lobillo, Estepona, lower Piacenzian, upper Pliocene.

Genus *Ptycheulimella* Sacco, 1892

Type species – *Tornatella pyramidata* Deshayes, 1835, by original designation, Pliocene, Greece.

1892a *Ptycheulimella* Sacco, p. 53.

Note – This genus contains species of medium size, with a relatively tall conical spire with a broad apical angle, flat-sided whorls, the base is angular, and the columella bears a low, but swollen fold at its adapical end. Members of this genus differ from *Eulimella* Forbes & MacAndrew, 1846 in having a broader conical spire and a columellar fold, absent in *Eulimella*. Species in the genus *Syrnola* A. Adams, 1860 are again slenderer, and the columellar fold is sharper.

***Ptycheulimella pyramidata* (Deshayes, 1832)**
Plate 180, figs 1-6

*1832	*Tornatella pyramidata* Deshayes, p. 154, pl. 24, figs 29-31.
1873	*Odostomia Michaelis* Brugnone, p. 7, pl. 1, fig. 7.
1892a	*Eulimella* (*Ptycheulimella*) *pyramidata* (Desh.) – Sacco, p. 60, pl. 2, fig. 30.
1904	*Ptycheulimella pyramidata* (Desh.) – Sacco, p. 109, pl. 24, fig. 11.
1992	*Eulimella pyramidata* (Deshayes, 1835 [*sic*]) – Cavallo & Repetto, p. 156, fig. 436.
?1999b	*Turbonilla eodem* Peñas & Rolán, p. 178, figs 63-66.
2019	*Eulimella pyramidata* (Deshayes, 1835 [*sic*]) – Cárdenas *et al*., p. 214, fig 8j.
non 1914	*Syrnola Michaelis* Brugn. – Cerulli-Irelli, p. 258 [432], pl. 22 [54], figs 56-57.
non 1969	*Eulimella* (*Ptycheulimella*) *pyramidata* (Deshayes) – Fekih, p. 53, pl. 11, fig. 4.
non 2011	*Eulimella pyramidata* (Deshayes, 1835 [*sic*]) – Chirli & Micali, p. 13, pl. 3, figs 6-9 [= *Macrodostomia bismichaelis* (Sacco, 1892)].

Material and dimensions – Maximum height 14.0 mm, width 4.5 mm. **CO**: NHMW 2019/0167/0265 (10). **VC**: NHMW 2019/0167/0225 (1), NHMW 2019/0167/0209 (4), NHMW 2019/0167/0494 (1), NHMW 2019/0167/0595 (1), NHMW 2019/0167/0706-0708 (2), NHMW 2019/0167/0710 (1). **EL**: NHMW 2019/0167/0732 (1).

Discussion – *Ptycheulimella pyramidata* (Deshayes, 1832) is one of the largest pyramidellids found in the Estepona assemblages. It is characterised by its tall conical spire, the early teleoconch whorls somewhat cyrtoconoid in profile, type B protoconch, of just over two whorls, with the nucleus almost completely obscured (Estepona specimen; dp = 450 μm, hp = 420 μm, tilted at angle of 135° to main shell axis), teleoconch of up to nine straight-sided whorls, separated by a moderately impressed, linear suture, last whorl 42% of the total height,

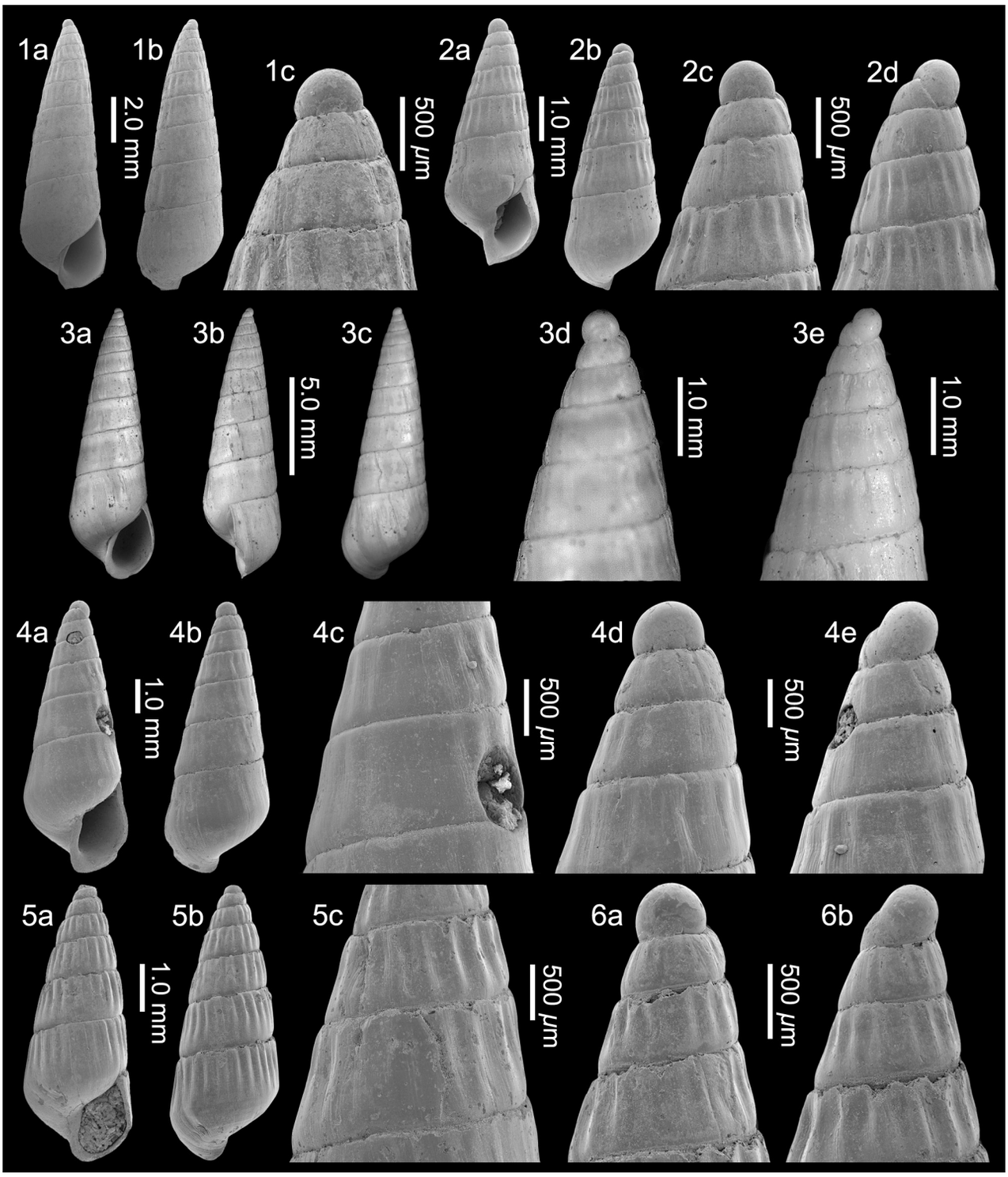

Plate 180. *Ptycheulimella pyramidata* (Deshayes, 1832); 1. NHMW 2019/0167/0225, height 12.3 mm, width 3.9 mm, 1c, detail of protoconch; 2. NHMW 2019/0167/0494, height 5.6 mm, width 2.1 mm, 2c-d, detail of protoconch (SEM images); 3. NHMW 2019/0167/0595, height 12.5 mm, width 4.0 mm, 3d-e, detail of protoconch (digital images); 4. NHMW 2019/0167/0706, height 8.0 mm, width 3.1 mm, 4c, detail of sculpture last two spire whorls, 4d-e, detail of protoconch; 5. NHMW 2019/0167/0707, height 5.8 mm, width 2.6 mm, 5c, detail of teleoconch sculpture last two spire whorls; 6. NHMW 2019/0167/0708, height 5.8 mm, width 2.6 mm, detail of protoconch (SEM images). Velerín carretera, Velerín, Estepona, lower Piacenzian, upper Pliocene.

straight sided to the rounded periphery, base convex, imperforate, aperture subquadrate, the outer lip rounded at the periphery, and the columella slightly oblique, thickened, with a weak, broad fold at its adapical end. The spire whorls bear weak but distinct ribs on the early teleoconch whorls.

The specimens from the Italian Pliocene figured by Chirli & Micali (2011, pl. 3, figs 6-9) as *Eulimella pyramidata* (Deshayes, 1835) are not that species but *Macrodostomia bismichaelis* (Sacco, 1892), the wrong specimen inadvertantly figured (*lapsus*).
Turbonilla eodem Peñas & Rolán, 1999 (1999b, p. 178, figs 63-66) described from the Atlantis Bank, about 300 km west of the Azores is remarkably like the smaller specimens of *P. pyramidata* (compare holotype of *T. eodem* with Pl. 180, fig. 5 herein). It is possible that they represent the same species. Unfortunately *T. eodem* is known only from the holotype and we refrain from formally synonymising the two.

Distribution – Upper Miocene: Atlantic, southern Spain (Cárdenas *et al*., 2019). Lower Pliocene: central Mediterranean, Italy (Crovato & Micali, 1992b). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Sacco, 1892a; Cavallo & Repetto, 1992).

Family Amathinidae Ponder, 1987
Genus *Clathrella* Récluz, 1864

Type species – *Nerita costata* Brocchi, 1814 (= *Fossarus clathratus* Philippi, 1844), by monotypy, Pliocene, Italy.

1864 *Clathrella* Récluz, p. 251.
1896 *Amathinoides* Sacco, p. 41. Type species (by original designation): *Nerita sulcosa* Brocchi, 1814, Pliocene, Italy.

***Clathrella clathrata* (Philippi 1844)**
Plate 181, figs 1-4

1814 *Nerita costata* Brocchi, 1814, p. 300, pl. 1, fig. 11 (junior homonym of *Nerita costata* Gmelin, 1791).
1828 *Turbo minutus* Michaud, p. 122, pl. unnumbered, figs 7-9 (junior homonym of *Turbo minutus* Brown *in* Allan, 1818).
*1844 *Fossarus clathratus* Philippi, p. 148, pl. 25, fig. 5.
1854 *Delphinula Costata* Millet, p. 157 (*nomen nudum*).
1856 *Fossarus costatus* Brocc. – Hörnes, p. 468, pl. 46, fig. 25.
1865 *Delphinula costata* Millet, p. 584 (*non* Danilo & Sandri, 1856).
1878 *Fossarus costatus* var. *crassicostata* Fontannes, p. 521, pl. 6, fig. 1.
1880 *Fossarus costatus* Brocchi – Fontannes, p. 180, pl. 10, fig. 12.
1896 *Phasianema costatum* (Br.) – Sacco, p. 17, pl. 1, fig. 32.
1896 *Phasianema costatum* var. *infracosticillata* Sacco, p. 17, pl. 1, fig. 33.
1896 *Phasianema costatum* var. *pluricostata* Sacco, p. 17, pl. 1, fig. 34.
1896 *Phasianema costatum* var. *parvulicincta* Sacco, p. 18, pl. 1, fig. 35.
1896 *Phasianema costatum* var. *paucicostata* Sacco, p. 18, pl. 1, fig. 36.
1904 *Fossarus* (*Phasianema*) *costatus* Brocchi – Dollfus *et al*., p. 9, pl. 33, fig. 1.
1914 *Fossarus* (*Phasianema*) *costatus* Br. – Cerulli Irelli, p. 187 [361], pl. 15 [47], figs 11-16.
1915 *Fossarus* (*Phasianema*) *costatus* Brocchi – Cossmann, p. 89, pl. 3, figs 46, 47, pl. 4, figs 49-50.
1923 *Fossarus costatus* Brocc. – Friedberg, p. 410, pl. 25, fig. 3.
1949a *Phasianema costatum* Brocchi, 1814 – Glibert, p. 198, pl. 12, fig. 12.
1954 *Phasianema costata burdigalensis* [*sic*] (d'Orb.) – Csepreghy-Meznerics, p. 26, pl. 2, fig. 22 [*non Carinorbis burdigalus* (d'Orbigny, 1852)].
1955 *Phasianema* (*Phasianema*) *costatum* (Brocchi) 1814 – Rossi Ronchetti, p. 150, fig. 76.
1960 *Fossarus* (*Phasianema*) *costatum* (Brocchi) – Švagrovský, p. 74, pl. 7, fig. 6.
1962 *Phasianema costatum burdigalum* Orbigny – Strausz, p. 110, pl. 46, fig. 29 [*non Carinorbis burdigalus* (d'Orbigny, 1852)].
1964 *Phasianema costata* Brocchi, 1814 – Brébion, p. 281.
1966 *Phasianema costatum burdigalum* Orbigny, 1852 – Strausz, p. 204, pl. 46, fig. 29 [*non Carinorbis burdigalus* (d'Orbigny, 1852)].
1968 *Fossarus costatus* (Brocchi, 1814) – Zelinskaya *et al*., p. 173, pl. 41, figs 13, 14.
1970 *Fossarus* (*Fossarus*) *costatus* (Brocchi) – Caprotti, p. 151, pl. 3, fig. 2.
1975 *Fossarus* (*Phasianema*) *costatus* (Brocchi) – Fekih, p. 72, pl. 25, fig. 3.
1976 *Fossarus costatus* (Brocchi) – Caprotti, p. 8, pl. 10, fig. 2.
1978 *Nerita costata* Brocchi, 1814 – Pinna & Spezia, p. 156, pl. 43, fig. 1.
1981 *Fossarus* (*Phasianema*) *costatus burdigalensis* [*sic*] (Orbigny) – Krach, p. 65, pl. 23, fig. 13 [*non Carinorbis burdigalus* (d'Orbigny, 1852)].
1984 *Clathrella clathratum* [*sic*] (Philippi, 1844) – Van Aartsen *et al*., p. 50, fig. 241.
1988 *Fossarus costatus* (Brocchi, 1814) – González Delgado, p. 120, pl. 1, figs 18, 19.
1992 *Clathrella clathrata* (Philippi, 1844) – Cavallo & Repetto, p. 154, fig. 433.
1996 *Clathrella clathrata* (Philippi, 1844) – Peñas *et al*., p. 75, fig. 53.
1997 *Fossarus costatus* (Brocchi) – Ruiz Muñoz, p. 168, pl. 31, figs 8-9.
1995 *Fossarus costatus* (Brocchi, 1814) – Bałuk, p. 171, pl. 4, figs 6-8.
2001 *Clathrella clathrata* (Philippi 1844) – Cachia *et al*., p. 91, pl. 14, fig. 8.
2001 *Clathrella clathrata* (Philippi 1844) – Silva, p. 569, pl. 26, figs 16, 17.
2004 *Clathrella clathrata* – Ardovini & Cossignani, p. 240, unnumbered fig.

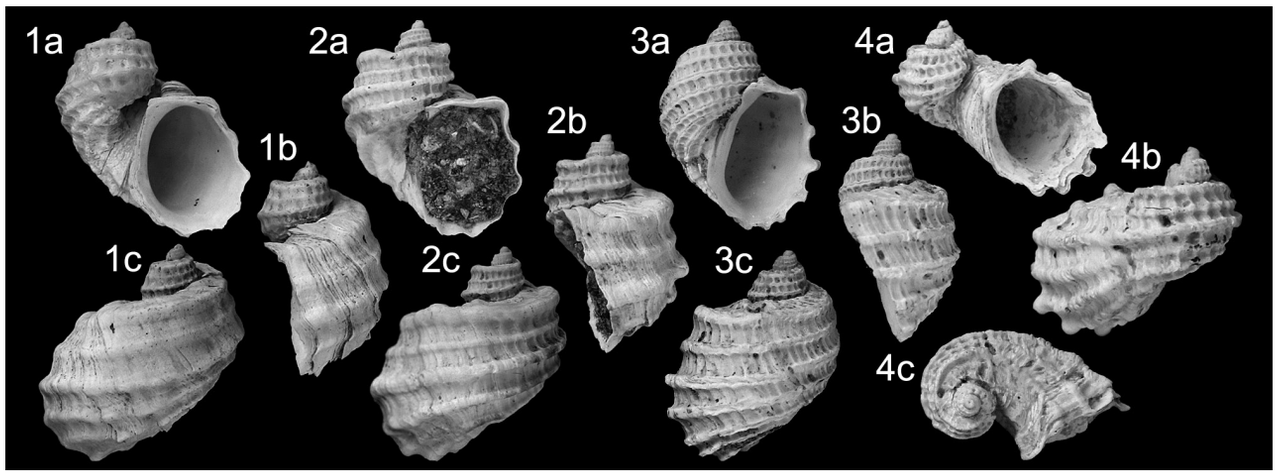

Plate 181. *Clathrella clathrata* (Philippi 1844); 1. NHMW 2019/0167/0226, height 14.7 mm, width 13.2 mm; 2. NHMW 2019/0167/0227, height 14.4 mm, width 11.1 mm; 3. NHMW 2019/0167/0228, height 12.2 mm, width 8.6 mm; 4. NHMW 2019/0167/0229, height 8.5 mm, width 10.7 mm. El Lobillo, Velerín, Estepona, lower Piacenzian, upper Pliocene.

2008 *Fossarus costatus* (Brocchi, 1814) – Chirli, p. 14, pl. 4, figs 6-10.
2013 *Clathrella clathrata* (Philippi 1844) – Landau *et al*., p. 319, pl. 52, fig. 12.
2014 *Clathrella clathrata* (Philippi 1844) – Brunetti, p. 74, unnumbered fig. bottom.
2014 *Clathrella clathrata* (Philippi 1844) – Giannuzzi-Savelli *et al*., p. 92, figs 313-317, appendix p. 37, 85.
2018 *Clathrella clathrata* (Philippi 1844) – Ceulemans *et al*., p. 138, pl. 8, figs 19, 20 (*cum syn*.).
2018 *Clathrella clathrata* (Philippi, 1844) – Brunetti & Cresti, p. 104, fig. 444.
2018 *Clathrella clathrata* (Philippi, 1844) – Trigo *et al*., p. 364, unnumbered fig.
2020 *Clathrella clathrata* (Philippi 1844) – Landau *et al*., p. 344, pl. 74, figs 1, 2.

non 1845 *Turbo minutus* Michaud – Grateloup, pl. 14, figs 24, 25 [= *Carinorbis burdigalus* (d'Orbigny, 1852)].
non 1896 *Phasianema costatum* var. *taurocrassa* Sacco, p. 18, pl. 1, fig. 37.

Material and dimensions – Maximum height 17.5 mm, width 17.5 mm. **CO**: NHMW 2019/0167/0231 (15). **VC**: NHMW 2019/0167/0232 (13). **EL**: NHMW 2019/0167/0226-0229 (4), NHMW 2019/0167/0230 (14).

Discussion – For discussion see Landau *et al*. (2013, p. 319; 2020, p. 344). The specimens from the Velerín conglomerates and El Lobillo reach a large size (up to 17 x 17 mm), similar to those figured by Landau *et al.* (2011, pl. 23, fig. 7) from the Atlantic lower Pliocene Arenas de Huelva Formation, southwestern Spain. Gerontic specimens are very thick-shelled with an expanded aperture, and in some specimens the last half whorl becomes disjunct (Pl. 181, fig. 4). Specimens from the Velerín carretera deposit are much smaller and similar in size and shape to those illustrated by Landau *et al*. (2020, pl. 74, figs 1, 2) from the Atlantic upper Miocene Assemblage I of NW France. In the extant populations this species is usually smaller sized, with specimens over 10 mm exceptional.

Distribution – Middle Miocene: Atlantic (Serravallian): Aquitaine Basin (Cossmann & Peyrot, 1919), (Langhian): Loire Basin, France (Glibert, 1949a); Paratethys (Langhian-Serravallian): Poland (Friedberg, 1923; Bałuk, 1995), Vienna (Hörnes, 1856), Hungary (Strausz, 1962, 1966), Ukraine (Zelinskaya *et al*., 1968), Slovakia (Švagrovský, 1960); Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau *et al*., 2013). Upper Miocene: Atlantic (Tortonian): NW France (Millet, 1854, 1865; Brébion, 1964; Landau *et al*., 2020), (Tortonian): Algarve Basin, Portugal (Dollfus *et al*., 1904). Lower Pliocene: Atlantic, NW France (Ceulemans *et al*., 2018), Guadalquivir Basin, Spain (González Delgado, 1988; Ruiz Muñoz *et al*., 1997; Landau *et al*., 2011); western Mediterranean, Roussillon Basin, France (Fontannes, 1880); central Mediterranean, Italy (Sacco, 1896; Forli *et al*., 1999; Chirli, 2008; Brunetti & Cresti, 2018); Tunisia (Fekih, 1975). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, S. Spain (this paper), central Mediterranean, Italy (Sacco, 1896; Caprotti, 1970, 1976; Cavallo & Repetto, 1992; Brunetti, 2014). Upper Pliocene-Pleistocene: Atlantic, northwestern France (Brébion, 1964). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914). Present-day: Atlantic, Galicia (Trigo *et al*., 2018) and the Cantabrian Sea, NW Spain (Han Raven pers. comm.). Madeira and Selvagens Islands (Segers *et al*., 2009), ?Atlantic or Mediterranean coast Morocco (Ardovini & Cossignani, 2004), western Mediterranean (Van Aartsen *et al*., 1984; Peñas *et al*., 1996), central Mediterranean (Cachia *et al*., 2001; Giannuzzi-Savelli *et al*., 2014).

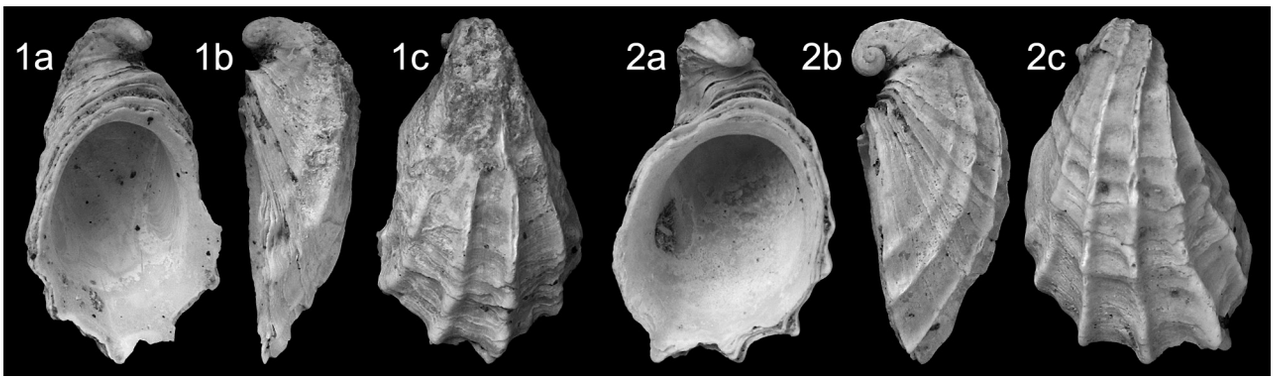

Plate 182: *Clathrella sulcosa* (Brocchi, 1814); 1. NHMW 2019/0167/0233, height 8.0 mm, maximum diameter 22.2 mm; 2. NHMW 2019/0167/0234, height 7.8 mm, maximum diameter 19.5 mm. Velerín conglomerates, Velerín, Estepona, lower Piacenzian, upper Pliocene.

***Clathrella sulcosa* (Brocchi, 1814)**
Plate 182, figs 1-2

*1814	*Nerita sulcosa* Brocchi, 1814, p. 298, pl. 1, fig. 3.
1856	*Capulus sulcosus* Brocc. – Hörnes, p. 637, pl. 50, fig. 20.
1896	*Amalthinoides sulcosa* (Br.) – Sacco, p. 41, pl. 5, fig. 7.
1896	*Amalthinoides sulcosa* var. *hamata* Sacco, p. 41.
1896	*Amalthinoides sulcosa* var. *subcristata* Sacco, p. 41, pl. 5, fig. 7.
1919	*Capulus* (*Amalthinoides*) *sulcosa* (Brocchi) Cossmann & Peyrot, p. 513, pl. 14, figs 55-57.
1949a	*Thyca* (*Cyclothyca*) *sulcosa* Brocchi 1814 – Glibert, p. 203, pl. 12, fig. 15.
1955	*Thyca* (*Cyclothyca*) *sulcosa* (Brocchi) 1814 – Rossi Ronchetti, p. 158, fig. 80.
1962	*Capulus sulcosus* Brocchi, 1814 – Strausz, p. 161, pl. 77, figs 18-19.
1966	*Capulus sulcosus* Brocchi, 1814 – Strausz, p. 208, pl. 77, figs 18-19.
1969	*Thyca* (*Cyclothyca*) *sulcosa* Brocchi – Csepreghy-Meznerics, p. 22, pl. 4, figs 24-25.
1978	*Nerita sulcosa* Brocchi, 1814 – Pinna & Spezia, p. 156, pl. 46, fig. 2.
1995	*Thyca* (*Cyclothyca*) *sulcosa* (Brocchi 1814) – Bałuk, p. 174, pl. 5, fig. 2.
2001b	*Nerita sulcosa* Brocchi, 1814 – Peñas & Rolán, p. 104, figs 1-3.
2018	*Thyca* (*Cyclothyca*) *sulcosa* (Brocchi 1814) – Turek, p. 95, pl. 8, fig. 3.

Material and dimensions – Maximum height 25.8 mm, diameter 17.4 mm. **CO**: NHMW 2019/0167/0233-0234 (2), NHMW 2019/0167/0235 (27).

Discussion – Warén (1980b, p. 188) suggested that the genus *Amanthinoides* Sacco, 1896 (type species *Nerita sulcosa* Brocchi, 1814, Pliocene, Italy) was probably best placed in the Capulidae based on the almost planispiral larval shell. However, Ponder (1987, p. 31) placed it in the Amathinidae and synonymised *Amanthinoides* with *Clathrella* Récluz, 1864, a position adopted here. *Clathrella sulcosa* (Brocchi, 1814) is so distinctive that it is impossible to confuse with any other species and there is little intraspecific variability. The only species that can be compared is *C. volumen* Peñas & Rolán, 2001 an extant species from West Africa, but *C. sulcosa* differs in attaining almost twice the maximum size, in having the last whorl more strongly disjunct and twisted, resulting in the spire being further from the aperture, in having a subcircular as opposed to ovate in *C. volumen*, in having sculpture composed of eight cords as opposed to 12-16 in *C. volumen*, and in lacking axials, weak, but present, in *C. volumen*.
We note that the Mondego Basin Pliocene specimens of *C. sulcosa* are all juveniles. At the time, the Mondego Basin was part of the cooler subtropical French Iberian Province (see Landau *et al*., 2011, p. 49, text-fig. 8). It is possible that larvae arrived here from the warmer tropical southern Pliocene Mediterranean-West African Province, but water temperatures were insufficient for this large *Clathrella* species to mature in the more northern latitudes of central-west Portugal.

Distribution – Middle Miocene: Atlantic, Aquitaine Basin (Langhian and Serravallian), Aquitaine Basin (Cossmann & Peyrot, 1919), Loire Basin (Langhian), France (Glibert, 1949a); Paratethys, Austria (Hörnes, 1856), Czech Republic (Turek, 2018), Hungary (Strausz, 1966; Csepreghy-Meznerics, 1969), Poland (Bałuk, 1995), Romania (Katona *et al*., 2011); western Proto-Mediterranean, NE Spain (Moreno *et al*., 2003). Upper Pliocene: Atlantic, Mondego Basin, Portugal (NHMW collection; NHMW 2018/0331/0290), western Mediterranean, Estepona Basin, S. Spain (this paper); central Mediterranean, Italy (Sacco, 1896; Rossi Ronchetti, 1955).

Conclusions

In this paper we review the Murchisonelloidea and Pyramidelloidea of the lower Piacenzian, upper Pliocene of Estepona, southern Spain. The same groups from the

roughly contemporaneous Atlantic assemblage of the Mondego Basin, central-west Portugal (Silva, 2001; Silva *et al*., 2010) have also been reviewed and included in the distribution data, but not figured. Six species of Murchisonelloidea are recorded, representing three genera, of which none are new. Pyramidelloidea are represented by 38 genera, of which two are new *Lafolletteia* nov. gen. and *Mulderia* nov. gen., and 178 species, of 15 are new: *Liostomia wilvanderstoelae* nov. sp., *Odostomia malagensis* nov. sp., *Ondina pinguis* nov. sp., *Mulderia mulderi* nov. sp., *Pyrgulina marliesae* nov. sp., *Chemnitzia silvai* nov. sp., *Pyrgiscus jaapmulderi* nov. sp., *Turbonilla bincki* nov. sp., *Turbonilla bongiardinoi* nov. sp., *Turbonilla crovatoi* nov. sp., *Turbonilla malacitana* nov. sp., *Turbonilla mauroi* nov. sp., *Turbonilla plioalboranensis* nov. sp., *Turbonilla velerinensis* nov. sp., and *Eulimella ariejansseni* nov. sp. Sixteen species are left in open nomenclature. This work is by no means exhaustive and many specimens that have not been figured remain in collection determined to genus level.

In their works on the pyramidellidae of West Africa, Peñas & Rolán (1997, 1998, 1999a, 2000, 2001a, 2001b, 2002) and Peñas *et al*. (2014) reported several species as occurring in the Estepona Pliocene that have been confirmed in this work. These records are merely a comment and are not illustrated. Of the dozen or so species listed the following are not confirmed herein: *Megastomia gilsoni* Dautzenberg, 1912 [is extremely similar to *M. conoidea* (Brocchi, 1814) and was considered a synonym of it by Van Aartsen *et al*. (1998, p. 34)], *Odostomia suboblonga* Jeffreys, 1884, *Turbonilla senegalensis* Von Maltzan, 1885 and *T. magnifica* (Seguenza, 1880) were not found, and *Turbonilla martae* Peñas & Rolán, 1997 is herein recorded as *Pyrgostylus lanceae* (Libassi, 1859).

This is an enormous diversity of pyramidellids, and the Estepona assemblage becomes one of the most diverse and most detailed studied in the European Neogene for these groups. The number of species fairly exceeds that known from the Pliocene of Tuscany, Italy (113 species Chirli & Micali, 2011). However, it must be noted that the Estepona assemblages include various outcrops representing faunas of different depths, whereas the Tuscany outcrops discussed by Chirli & Micali are more bathymetrically homogeneous. If one adds the pyramidellids from deeper-water assemblages in Italy (*e.g*., Rio Torsero, Savona), the total number is similar to that found in the Pliocene of Italy (195 species identified, some still need to be determined, total about 210 species; PM unpublished data). It is more diverse than the 146 (Lessepsian immigrants excluded) species found today in the Mediterranean (Giannuzzi-Savelli *et al*., 2014).

Compared to other gastropod groups, Murchisonelloidea and Pyramidelloidea are relatively long-lived, with 96 of the 184 (52%) species still living (compare with Trivioidea Troschel, 1863 and Cypraeoidea Rafinesque, 1815: 3%, *fide* Landau & Fehse, 2004; Nassariidae Iredale, 1916: 15%, *fide* Landau *et al*., 2009; Cancellariidae Forbes & Hanley, 1851: 15%, *fide* Landau *et al*., 2006b; Marginellidae Fleming, 1828 and Cystiscidae Stimpson, 1865: 17%, *fide* Landau *et al*., 2006c; Muricidae Rafinesque, 1815: 16%, *fide* Landau *et al*., 2007). It is higher than in well-known relatively cosmopolitan groups such as the Tonnoidea Suter, 1913 (35%, *fide* Landau *et al*., 2004b) and Epitoniidae Berry, 1910 (30%, *fide* Landau *et al*., 2006c).

Seventy-two species (39%) (88 minus 16 species left in open taxonomy) are extinct taxa described to species level, of which 15 are new (8%). As can be seen from the distribution tables (Table 1), the assemblage from Estepona shares many species with the Pliocene of Italy. Almost all the fossil species known previous to this work were originally described from the Italian Neogene, most by Sacco (1892a, b) supplemented by a few more recent works (Chirli & Micali, 2011; Bongiardino & Micali, 2018). This is to be expected as both Italy and southern Spain are situated geographically within the Tropical Pliocene Mediterranean-West African Biogeographical Province (see Landau & Silva, 2006b, Silva & Landau, 2007; Landau *et al*., 2011; *inter alia*).

What is striking, however, is the number of present-day West African species present in the assemblage. Chirli & Micali (2011, p. VI) noted that some West African species were present in the Pliocene assemblage from Tuscany. This was again noted by Bellagamba & Micali (2016, p. 138, table 1 text). In the Italian Pliocene assemblages 13 species are West African and no longer found in the Mediterranean (PM unpublished data).

In the Estepona assemblage the following 27 species (15%) are 'West African', that is, not reported from the Mediterranean or only from the Alboran Sea: *Pseudochileutomia carinata* (de Folin, 1870), *Longchaeus inopinatus* (Schander, 1994), *Liostomia wareni* Schander, 1994, *Odostomia bernardi* Van Aartsen, Gittenberger & Goud, 1998, *O. digitulus* Peñas & Rolán, 1999, *O. dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998, *O. gomezi* Peñas, Rolán & Swinnen, 2014, *O. jacquesi* Peñas & Rolán, 1999, *O. romburghi* Van Aartsen, Gittenberger & Goud, 1998, *Ondina mosti* Van Aartsen, Gittenberger & Goud, 1998, *Parthenina feldi* (Van Aartsen, Gittenberger & Goud, 2000), *P. turbonillaeformis* (Van Aartsen, Gittenberger & Goud, 2000), *Pyrgulina vanderlindeni* (Van Aartsen, Gittenberger & Goud, 2000), *Chemnitzia diezi* (Peñas & Rolán, 1997), *C. luandensis* (Peñas & Rolán, 1997), *Pyrgiscus abrardi* (Fischer-Piette & Nicklès, 1946), *P. coseli* Peñas & Rolán, 2002, *P. inaequabilis* (Peñas & Rolán, 1997), *P. joubini* (Dautzenberg, 1912), *P. kerstinae* Schander, 1994, *P. pablopenasi* Peñas, Rolán & Swinnen, 2014, *Turbonilla haullevillei* Dautzenberg, 1912, *T. pseudomarteli* Peñas & Rolán, 1997, *Eulimella ignorabilis* Peñas & Rolán, 1997, *Eulimella perturbata* Peñas, Rolán & Swinnen, 2014, *Eulimella trewae* Van Aartsen, Gittenberger & Goud, 2000, *Eulimella variabilis* De Folin, 1870.

This cohort of species found in the Estepona assemblages, that today occur in warmer tropical waters off West Africa, but in the Pliocene had a more northern distribution, extending their range into the western Mediterranean. Today there are several pyramidellid species living in West Africa that extend their range into the Alboran Sea [*e.g.*, *Strioturbonilla sigmoidea* (Monterosato, 1880), *Pyrgolidium internodulum* (Wood, 1848), *Turbonilla subulina* Monterosato, 1889 and *Liamorpha elegans* (de Folin, 1870)]. These are found occasionally and probably represent sink populations, in which the larvae are transported from tropical West Africa by incoming Atlantic currents, but they fail to reproduce within the cooler Mediterranean or just manage to maintain small populations that do not extend further into the Mediterranean. However, the number of species listed above shows this was much more evident during the Mediterranean Plio-Pleistocene Molluscan Unit 1 (MPPMU1; for discussion on Pliocene Molluscan Units and renaming Raffi & Monegatti's 1993 MPMU to MPPMU; see Landau *et al*., 2011, p. 47), which was in place during a time roughly equivalent to the Zanclean and lower Piacenzian. There is no reason why viable populations could not have thrived within the tropical Mediterranean Pliocene waters which at the time were part of the same tropical Mediterranean-West African biogeographical province, especially as some of these species have also been recorded in the Italian Pliocene and therefore were widespread in the Mediterranean during MPPMU1 (*e.g.*, *Odostomia dijkhuizeni* Van Aartsen, Gittenberger & Goud, 1998, *Odetta marci* Van Aartsen, Gittenberger & Goud, 1998, *Folinella holthuisi* Van Aartsen, Gittenberger & Goud, 1998, *Parthenina feldi* (Van Aartsen, Gittenberger & Goud, 2000), *P. willeminae* (Van Aartsen, Gittenberger & Goud, 2000), *Turbonilla beidaensis* Peñas & Rolán, 2000, *T. senegalensis* von Maltzan, 1885, *T. pseudomarteli* Peñas & Rolán, 1997, *inter alia*).

This 'West African flavour' to the Estepona assemblages that did not penetrate further into the Mediterranean during MPPMU1 has been reported before (Landau & Marquet, 2000; Landau *et al*., 2006c, 2007, and a highly diverse assemblage of *Chauvetia* Monterosato, 1884 species similar to that found along the coast of West Africa; Landau in prep.).

At genus level, *Macrodostomia* Sacco, 1892 is the only extinct genus. *Lafolletteia* nov. gen. no longer occurs in the Atlantic or Mediterranean, and the only living representative is from the Pacific. *Mulderia* nov gen. includes a cohort of extant tropical western Atlantic and fossil Neogene western Atlantic and European species that had previously been placed in a variety of pyramidellid genera. It identifies a thermophilic Atlantic genus represented on both sides of the Atlantic in the Miocene, but today restricted to Tropical West Atlantic.

The pyramidellid genus *Pseudoscilla* Boettger, 1902 present in Estepona and the Italian Pliocene (Sosso *et al*., 2009) is a thermophilic genus today in the eastern Atlantic restricted to the Tropical coasts of West Africa. *Pseudoscilla* was possibly widespread in the Atlantic and Pacific during the Miocene, as today it is present on both sides of Atlantic and Pacific (Peñas & Rolán, 1999c, p. 11). As can be seen from the distribution tables (Table 1) several other genera such as *Longchaeus* Mörch, 1875, *Auristomia* Monterosato, 1884, *Puposyrnola* Cossmann, 1921, *Pyrgiscus* Philippi, 1841 [except *P. rufus* (Philippi, 1836), which as used by present authors may represent a specis complex], *Pyrgolidium* Monterosato, 1884, and *Pyrgostylus* Monterosato, 1884 are relatively thermophilic and not found today further north than the Mediterranean-Moroccan Biogeographical Province.

Acknowledgements

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For references see page 378

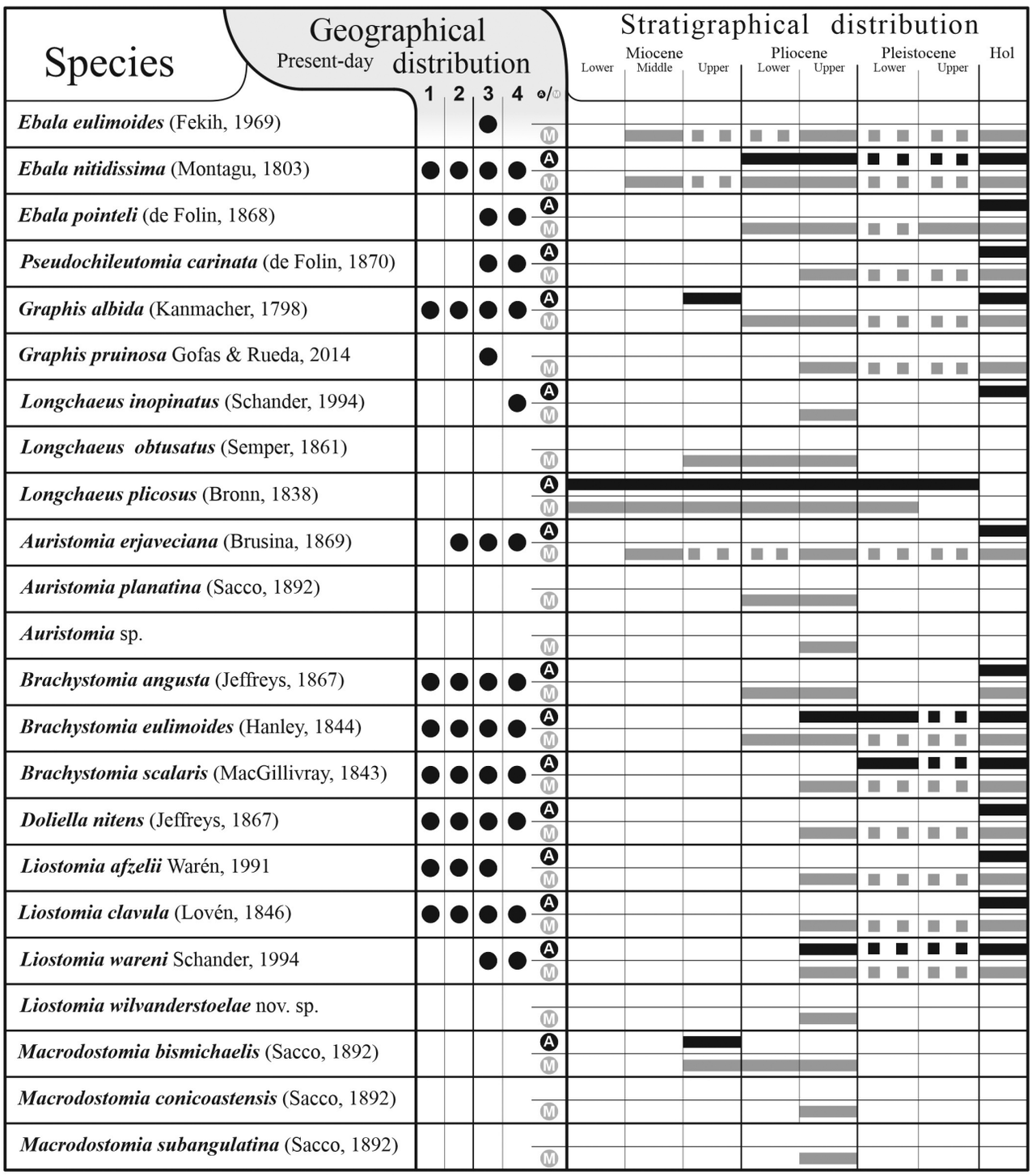
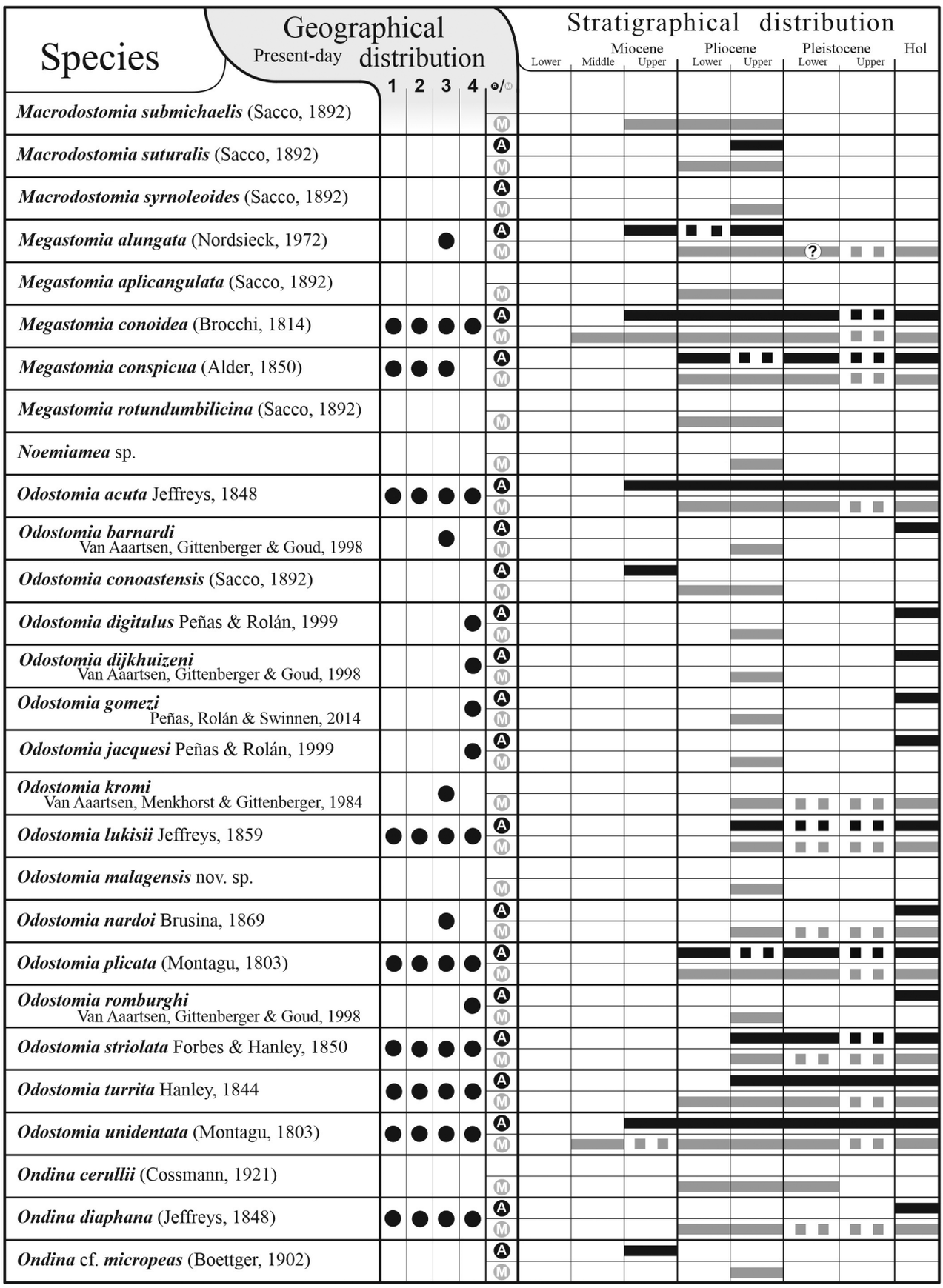
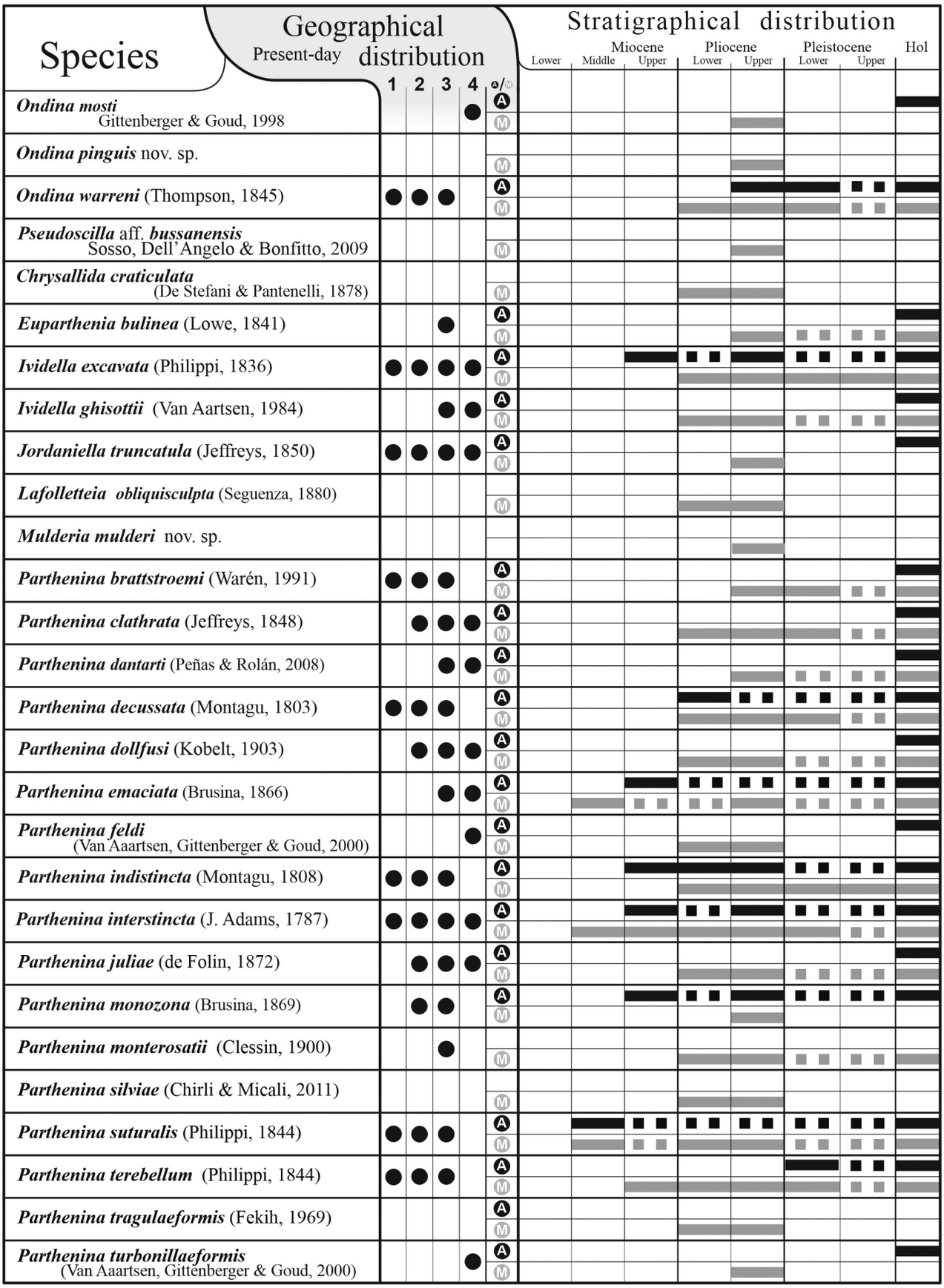


Figure 1. Geography, stratigraphy and distribution of species found in the upper Pliocene lower Piacenzian of the Estepona Basin, southern Spain. For Recent geographic distribution designated by biogeographical province: 1 = Boreal-Celtic Province, 2 = French-Iberian Province, 3 = Mediterranean-Moroccan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


Species
Geographical
Present-day distribution
1
2
3
4
Stratigraphical distribution
Miocene
Pliocene
Pleistocene
Hol
Lower
Middle
Upper
Lower
Upper
Lower
Upper
Macrodostomia submichaelis (Sacco, 1892)
Macrodostomia suturalis (Sacco, 1892)
Macrodostomia syrnoleoides (Sacco, 1892)
Megastomia alungata (Nordsieck, 1972)
Megastomia aplicangulata (Sacco, 1892)
Megastomia conoidea (Brocchi, 1814)
Megastomia conspicua (Alder, 1850)
Megastomia rotundumbilicina (Sacco, 1892)
Noemiamea sp.
Odostomia acuta Jeffreys, 1848
Odostomia barnardi Van Aaartsen, Gittenberger & Goud, 1998
Odostomia conoastensis (Sacco, 1892)
Odostomia digitulus Peñas & Rolán, 1999
Odostomia dijkhuizeni Van Aaartsen, Gittenberger & Goud, 1998
Odostomia gomezi Peñas, Rolán & Swinnen, 2014
Odostomia jacquesi Peñas & Rolán, 1999
Odostomia kromi Van Aaartsen, Menkhorst & Gittenberger, 1984
Odostomia lukisii Jeffreys, 1859
Odostomia malagensis nov. sp.
Odostomia nardoi Brusina, 1869
Odostomia plicata (Montagu, 1803)
Odostomia romburghi Van Aaartsen, Gittenberger & Goud, 1998
Odostomia striolata Forbes & Hanley, 1850
Odostomia turrita Hanley, 1844
Odostomia unidentata (Montagu, 1803)
Ondina cerullii (Cossmann, 1921)
Ondina diaphana (Jeffreys, 1848)
Ondina cf. micropeas (Boettger, 1902)


Species
Geographical
Present-day distribution
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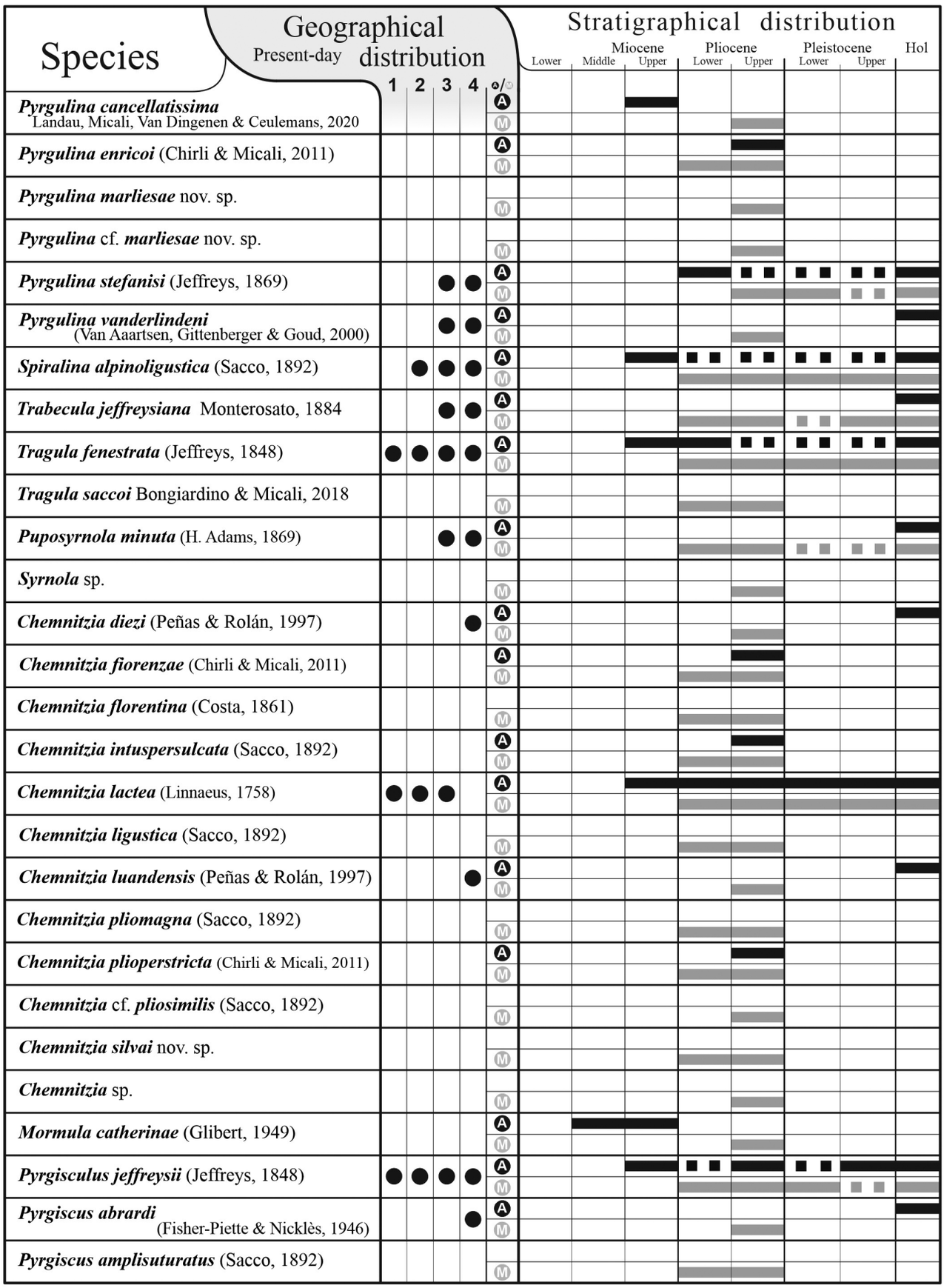
Stratigraphical distribution
Miocene
Pliocene
Pleistocene
Hol
Lower
Middle
Upper
Lower
Upper
Lower
Upper
A
M
Ondina mosti Gittenberger & Goud, 1998
Ondina pinguis nov. sp.
Ondina warreni (Thompson, 1845)
Pseudoscilla aff. ***bussanensis*** Sosso, Dell'Angelo & Bonfitto, 2009
Chrysallida craticulata (De Stefani & Pantenelli, 1878)
Euparthenia bulinea (Lowe, 1841)
Ividella excavata (Philippi, 1836)
Ividella ghisottii (Van Aartsen, 1984)
Jordaniella truncatula (Jeffreys, 1850)
Lafolletteia obliquisculpta (Seguenza, 1880)
Mulderia mulderi nov. sp.
Parthenina brattstroemi (Warén, 1991)
Parthenina clathrata (Jeffreys, 1848)
Parthenina dantarti (Peñas & Rolán, 2008)
Parthenina decussata (Montagu, 1803)
Parthenina dollfusi (Kobelt, 1903)
Parthenina emaciata (Brusina, 1866)
Parthenina feldi (Van Aaartsen, Gittenberger & Goud, 2000)
Parthenina indistincta (Montagu, 1808)
Parthenina interstincta (J. Adams, 1787)
Parthenina juliae (de Folin, 1872)
Parthenina monozona (Brusina, 1869)
Parthenina monterosatii (Clessin, 1900)
Parthenina silviae (Chirli & Micali, 2011)
Parthenina suturalis (Philippi, 1844)
Parthenina terebellum (Philippi, 1844)
Parthenina tragulaeformis (Fekih, 1969)
Parthenina turbonillaeformis (Van Aaartsen, Gittenberger & Goud, 2000)


Species
Geographical
Present-day distribution
1
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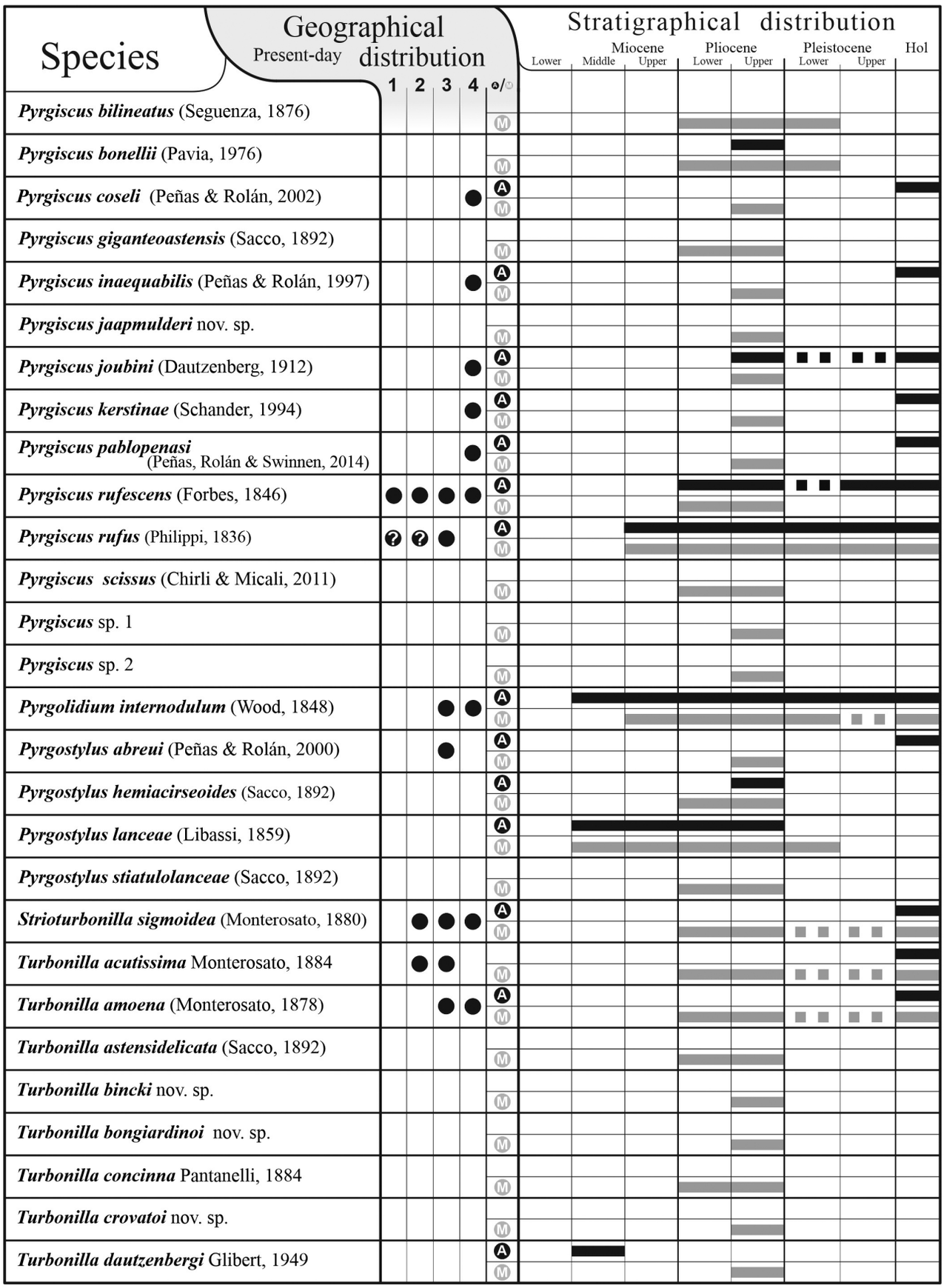
Stratigraphical distribution
Miocene
Pliocene
Pleistocene
Hol
Lower
Middle
Upper
Lower
Upper
Lower
Upper
Pyrgulina cancellatissima Landau, Micali, Van Dingenen & Ceulemans, 2020
Pyrgulina enricoi (Chirli & Micali, 2011)
Pyrgulina marliesae nov. sp.
Pyrgulina cf. marliesae nov. sp.
Pyrgulina stefanisi (Jeffreys, 1869)
Pyrgulina vanderlindeni (Van Aaartsen, Gittenberger & Goud, 2000)
Spiralina alpinoligustica (Sacco, 1892)
Trabecula jeffreysiana Monterosato, 1884
Tragula fenestrata (Jeffreys, 1848)
Tragula saccoi Bongiardino & Micali, 2018
Puposyrnola minuta (H. Adams, 1869)
Syrnola sp.
Chemnitzia diezi (Peñas & Rolán, 1997)
Chemnitzia fiorenzae (Chirli & Micali, 2011)
Chemnitzia florentina (Costa, 1861)
Chemnitzia intuspersulcata (Sacco, 1892)
Chemnitzia lactea (Linnaeus, 1758)
Chemnitzia ligustica (Sacco, 1892)
Chemnitzia luandensis (Peñas & Rolán, 1997)
Chemnitzia pliomagna (Sacco, 1892)
Chemnitzia plioperstricta (Chirli & Micali, 2011)
Chemnitzia cf. pliosimilis (Sacco, 1892)
Chemnitzia silvai nov. sp.
Chemnitzia sp.
Mormula catherinae (Glibert, 1949)
Pyrgisculus jeffreysii (Jeffreys, 1848)
Pyrgiscus abrardi (Fisher-Piette & Nicklès, 1946)
Pyrgiscus amplisuturatus (Sacco, 1892)


Species
Geographical
Present-day distribution
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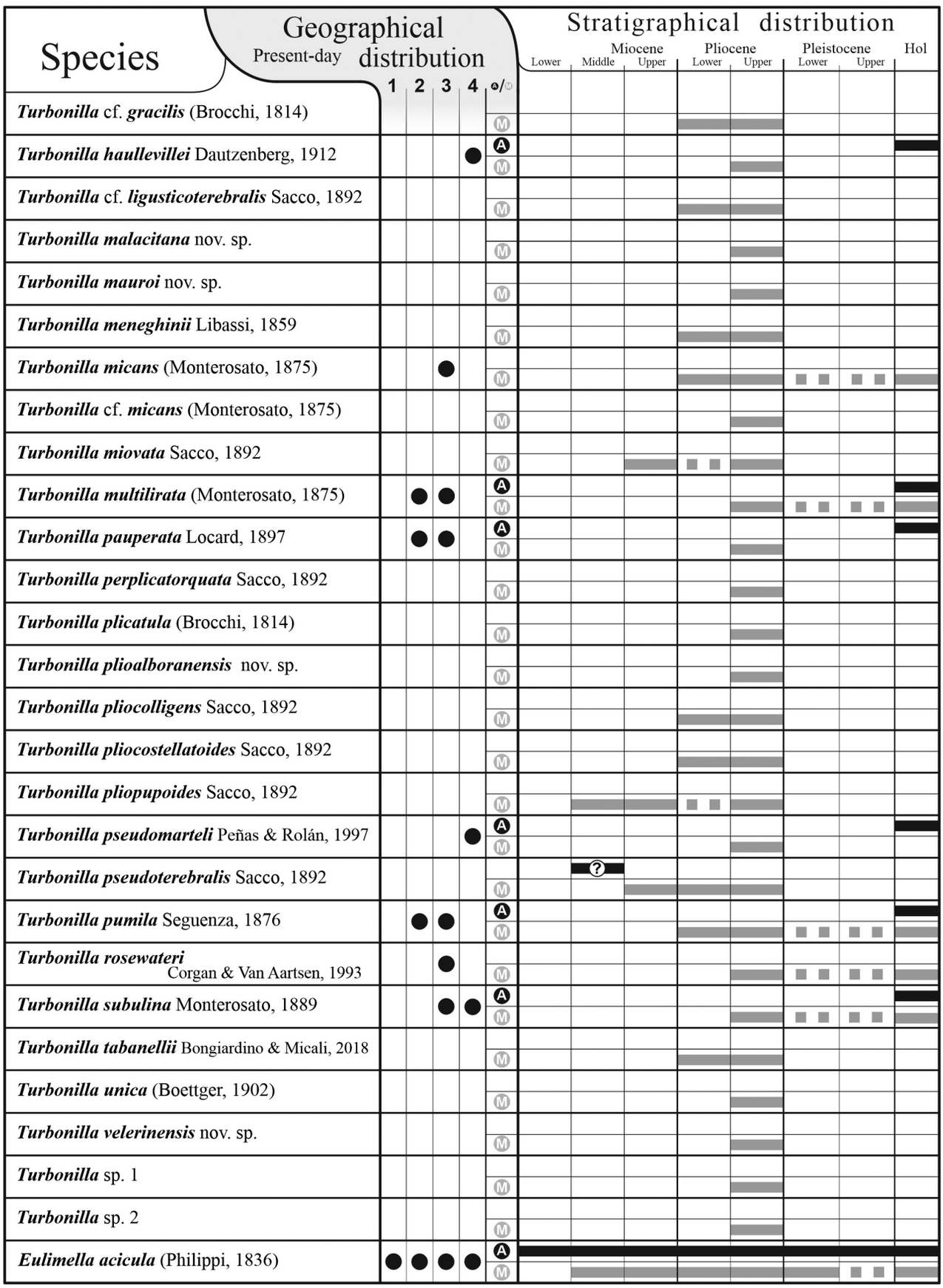
♂/♀
Stratigraphical distribution
Miocene
Pliocene
Pleistocene
Hol
Lower
Middle
Upper
Lower
Upper
Lower
Upper
Pyrgiscus bilineatus (Seguenza, 1876)
Pyrgiscus bonellii (Pavia, 1976)
Pyrgiscus coseli (Peñas & Rolán, 2002)
Pyrgiscus giganteoastensis (Sacco, 1892)
Pyrgiscus inaequabilis (Peñas & Rolán, 1997)
Pyrgiscus jaapmulderi nov. sp.
Pyrgiscus joubini (Dautzenberg, 1912)
Pyrgiscus kerstinae (Schander, 1994)
Pyrgiscus pablopenasi (Peñas, Rolán & Swinnen, 2014)
Pyrgiscus rufescens (Forbes, 1846)
Pyrgiscus rufus (Philippi, 1836)
Pyrgiscus scissus (Chirli & Micali, 2011)
Pyrgiscus sp. 1
Pyrgiscus sp. 2
Pyrgolidium internodulum (Wood, 1848)
Pyrgostylus abreui (Peñas & Rolán, 2000)
Pyrgostylus hemiacirseoides (Sacco, 1892)
Pyrgostylus lanceae (Libassi, 1859)
Pyrgostylus stiatulolanceae (Sacco, 1892)
Strioturbonilla sigmoidea (Monterosato, 1880)
Turbonilla acutissima Monterosato, 1884
Turbonilla amoena (Monterosato, 1878)
Turbonilla astensidelicata (Sacco, 1892)
Turbonilla bincki nov. sp.
Turbonilla bongiardinoi nov. sp.
Turbonilla concinna Pantanelli, 1884
Turbonilla crovatoi nov. sp.
Turbonilla dautzenbergi Glibert, 1949


Species
Geographical
Present-day distribution
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♂/♀
Stratigraphical distribution
Lower
Miocene
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Pliocene
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Upper
Pleistocene
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Upper
Hol
Turbonilla cf. gracilis (Brocchi, 1814)
Turbonilla haullevillei Dautzenberg, 1912
Turbonilla cf. ligusticoterebralis Sacco, 1892
Turbonilla malacitana nov. sp.
Turbonilla mauroi nov. sp.
Turbonilla meneghinii Libassi, 1859
Turbonilla micans (Monterosato, 1875)
Turbonilla cf. micans (Monterosato, 1875)
Turbonilla miovata Sacco, 1892
Turbonilla multilirata (Monterosato, 1875)
Turbonilla pauperata Locard, 1897
Turbonilla perplicatorquata Sacco, 1892
Turbonilla plicatula (Brocchi, 1814)
Turbonilla plioalboranensis nov. sp.
Turbonilla pliocolligens Sacco, 1892
Turbonilla pliocostellatoides Sacco, 1892
Turbonilla pliopupoides Sacco, 1892
Turbonilla pseudomarteli Peñas & Rolán, 1997
Turbonilla pseudoterebralis Sacco, 1892
Turbonilla pumila Seguenza, 1876
Turbonilla rosewateri Corgan & Van Aartsen, 1993
Turbonilla subulina Monterosato, 1889
Turbonilla tabanellii Bongiardino & Micali, 2018
Turbonilla unica (Boettger, 1902)
Turbonilla velerinensis nov. sp.
Turbonilla sp. 1
Turbonilla sp. 2
Eulimella acicula (Philippi, 1836)
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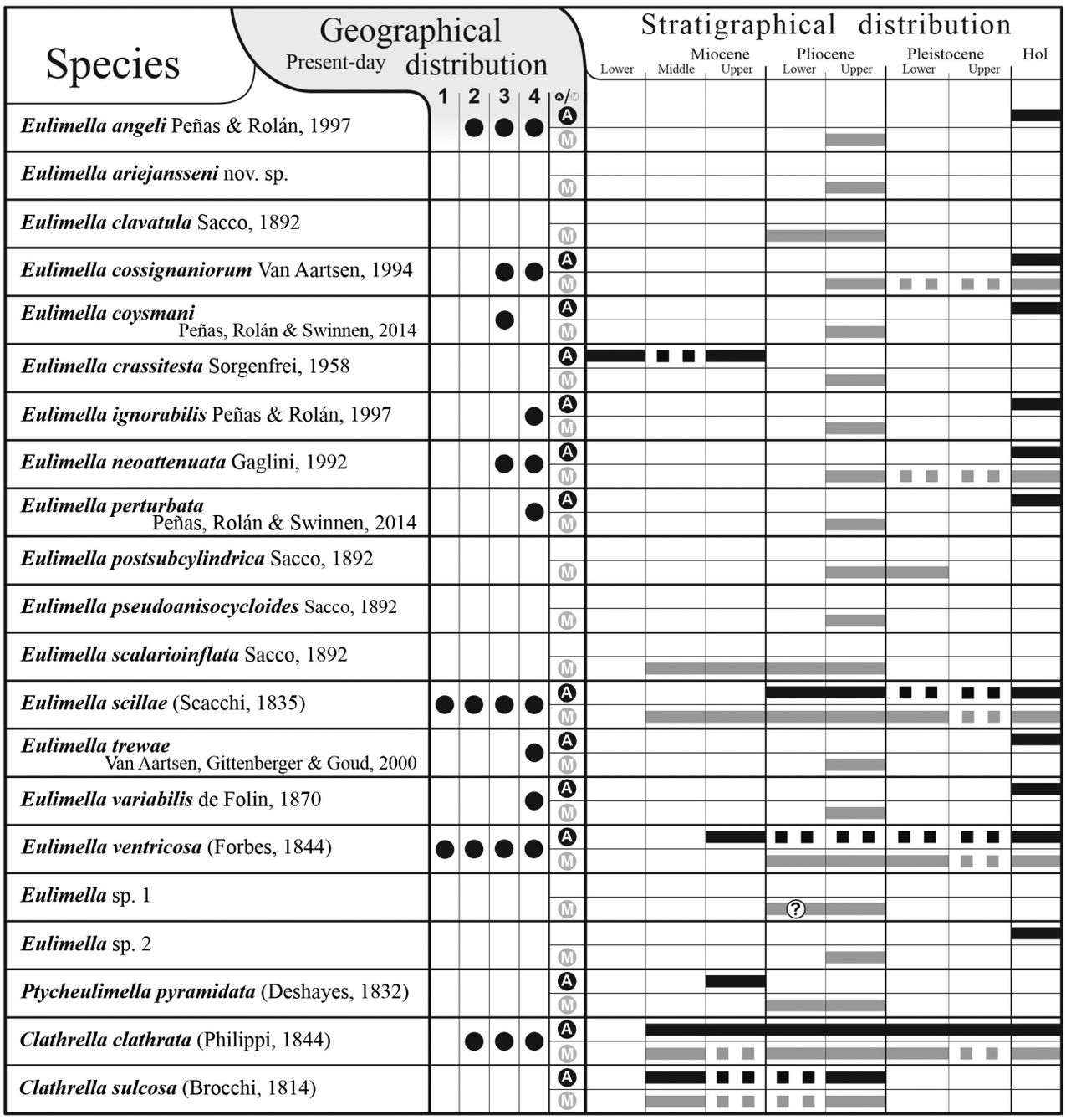
Species
Geographical
Present-day distribution
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♂/♀
Stratigraphical distribution
Miocene
Pliocene
Pleistocene
Hol
Lower
Middle
Upper
Lower
Upper
Lower
Upper
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M
Eulimella angeli Peñas & Rolán, 1997
Eulimella ariejansseni nov. sp.
Eulimella clavatula Sacco, 1892
Eulimella cossignaniorum Van Aartsen, 1994
Eulimella coysmani Peñas, Rolán & Swinnen, 2014
Eulimella crassitesta Sorgenfrei, 1958
Eulimella ignorabilis Peñas & Rolán, 1997
Eulimella neoattenuata Gaglini, 1992
Eulimella perturbata Peñas, Rolán & Swinnen, 2014
Eulimella postsubcylindrica Sacco, 1892
Eulimella pseudoanisocycloides Sacco, 1892
Eulimella scalarioinflata Sacco, 1892
Eulimella scillae (Scacchi, 1835)
Eulimella trewae Van Aartsen, Gittenberger & Goud, 2000
Eulimella variabilis de Folin, 1870
Eulimella ventricosa (Forbes, 1844)
Eulimella sp. 1
Eulimella sp. 2
Ptycheulimella pyramidata (Deshayes, 1832)
Clathrella clathrata (Philippi, 1844)
Clathrella sulcosa (Brocchi, 1814)

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