

Additions and corrections to the gastropod fauna of the Pliocene of Estepona, south-western Spain, 5

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Abstract

Seventeen small species of gastropod are added to the fauna of the Lower Piacenzian Pliocene of Estepona, of which six are described as new: *Skenea gofasi* spec. nov., *Papuliscaia spinosa* spec. nov., *Narrimania saldubensis* spec. nov., *Ophiulima lobilloensis* spec. nov., *Talassia plioalboranensis* spec. nov., and *Specula estebbunensis* spec. nov.

Key words. Gastropoda, Pliocene, Estepona, Spain, additions, new taxon

ZooBank registration. urn:lsid:zoobank.org:pub:A77EDEF1-711B-4015-91B4-775C7B8562ED

Introduction

A systematic review of the highly diverse Lower Piacenzian upper Pliocene of the Estepona assemblages of south-western Spain has been the focus of our team since 2003. Subsequent to the systematic accounts, further records appear that have been dealt with in a second series recording and describing additions to the fauna. In the fourth of these “additions” series, Landau & Mulder (2020: 26) listed all the systematic contributions to date published not only by our team, but also by other researchers. They estimated the gastropod diversity at about 800 species. Since then, four further systematic taxonomic contributions have been published [Landau & Micali, 2001 (Murchisonelloidea and Pyramidelloidea); Landau & Harzhauser, 2020a (Clavatulidae); Landau & Harzhauser, 2022b (Borsoniidae, Clathurellidae, Mitromorphidae, Pseudomelatomidae); Landau et al., 2022 (Raphitomidae)] as a

result of which the taxonomic diversity must be re-estimated to closer to 1000 gastropod species.

This paper is the fifth in the “additions” series in which we record 17 species from the Lower Piacenzian that have so far eluded us, mainly due to their small size. Most are also uncommon to rare in these deposits. All are from the Velerín sands (VS) and El Lobillo (EL) (also known as Finca de Franco) localities.

Geological and Paleoenvironmental Setting

Prior to 2013 the age of the deposits was stated as Upper Zanclean (upper Lower Pliocene) (for list of papers giving Zanclean age see Landau & Micali, 2021: 202, following Guerra Merchán et al. (2002). In our later works (e.g., Landau & Mulder, 2020; Landau & Micali, 2021) 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).

The stratigraphy of the Estepona assemblages was described by Aguirre et al. (2005). The Velerín conglomerates represent inner fan-delta facies with considerable transport from the source area, the Velerín antenna section a transition from inner to outer fan-delta facies, the Velerín carretera and Parque Antena silts and fine-grained sands correspond to the transition from the outer fan-delta to the platform, representing deeper-water deposition. The El Lobillo area was not sampled by those authors, it includes a combination of shallow and deep-water taxa. The species described herein, of which most are from El Lobillo, suggest a deeper-water habitat.

Materials and Methods

The *Estepona* material described herein was collected by the junior author; it was deposited in the Natural History Museum Vienna (NHMW), where it is housed together with the senior author's collection donated to the same institution.

The specimens included in this paper are all very small and encrusted. The usual technique with this material of cleaning with a toothbrush and water was not possible. The specimens were therefore soaked in a bath of 10% w/v sodium dodecyl sulphate (= sodium lauryl sulphate) (guaranteed absolutely ph-neutral) for ten minutes, rinsed in tap water and cleaned with a very fine paintbrush. This gave relatively good results with most of the encrusting dirt falling off. We thank Serge Gofas of the University of Málaga, Spain, for advising us on this technique.

Many of the new species are described based on a single specimen. We acknowledge that this is a weakness in this paper, as intraspecific variability cannot be assessed. However, these species are all extremely uncommon in the assemblages, and only coming to light after many years of intensive search. In many cases they are the only representative in the assemblage of the genus and are so distinctive that we are convinced they are undescribed. In order to assess the species diversity of the assemblage it is important to describe these rarities.

For further discussion and map of localities, see Landau et al. (2003: 4, text fig. 1).

Abbreviations: EL = El Lobillo, VS = Velerín sands.

Systematic Paleontology

Superfamily Trochoidea Rafinesque, 1815

Family Skeneidae Clark, 1851

Genus *Skenea* Fleming, 1825

Skenea Fleming, 1825: 246. Type species (by subsequent designation, Gray, 1847): *Helix serpuloides* Montagu, 1808, present-day, British Isles.

Skenea dautzenbergi (Glibert, 1949)

Figure 1a–d

Circulopsis dautzenbergi Glibert, 1949: 71, pl. 5 fig.1.

Skenea dautzenbergi (Glibert, 1949)—Landau et al., 2017: 149, pl. 73 fig. 1.

Material and dimensions. NHMW2022/0070/0013, maximum diameter 1.5 mm, height 920 µm (EL 1).

Discussion. The single specimen from El Lobillo represents the same species as that illustrated by Landau

et al. (2017: 149, pl. 73 fig. 1) from the Tortonian (Upper Miocene) of northwestern France as *Skenea dautzenbergi* (Glibert, 1949). It differs from the type species *S. serpuloides* (Montagu, 1808), from the present-day eastern Atlantic and Mediterranean, *S. pelagia* Nofroni & Valenti, 1987 and *S. giemellorum* Romani, Bogi & Bartolini, 2015 in that these three species have stronger spiral sculpture, which covers the entire teleoconch surface instead of being limited to the periumbilical area, and the umbilical cords are not strongly developed. For further discussion, see Landau et al. (2017: 149).

Distribution. Middle Miocene: Atlantic, Loire Basin, France (Glibert, 1949). Upper Miocene: Tortonian, northwestern France (Landau et al., 2017). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper).

Skenea gofasi spec. nov.

Figure 2a–d

ZooBank registraton. urn:lsid:zoobank.org:act:84E60871-BFEE-40F2-8433-833653590CA1

Type material. Holotype NHMW2022/0070/0019, maximum diameter 1.4 mm, height 825 µm.

Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

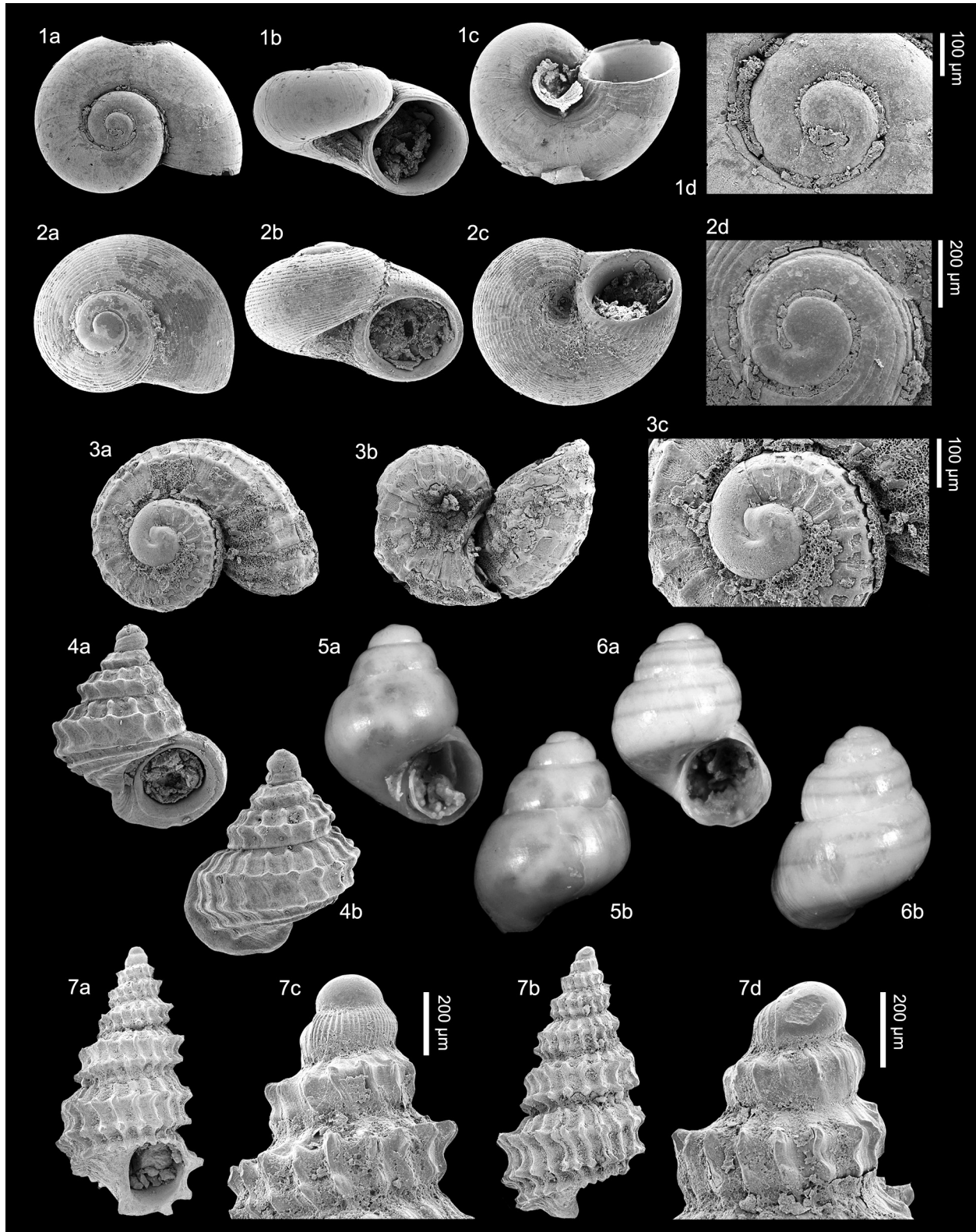
Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Named the malacologist Serge Gofas of the University of Malaga, Spain, in recognition of his many works on the subject and the excellent advice he has given the senior author over the years. *Skenea* gender feminine.

Diagnosis. *Skenea* species of minute size (width 1.4 mm), solid, 1½ teleoconch whorls, first ½ teleoconch whorl with single suprasutural cords, cords on entire body whorl with fine spirals, umbilicus rounded, deep, aperture circular, peristome thickened.

Description. Shell moderately depressed lenticular with flattened spire. Protoconch paucispiral, smooth, flattened, of just over one whorl with large nucleus and flexuous lip, diameter 0.31 mm. Sharply delimited from teleoconch by scar and change in sculpture. Teleoconch of just over 1½ whorls, first ½ whorl bearing single narrow suprasutural cord, rest of whorl surface smooth. Last whorl, further subequal spirals develop progressively from periphery towards adapical suture, so that subsutural cord last to appear. Last whorl strongly convex, sculpture about 22 cords over entire surface including base, umbilicus relatively broad and deep; base and umbilicus not sharply delimited. Fine, close-set growth lines present in spiral interspaces, giving sculpture on last whorl very finely reticulated appearance. Aperture circular, prosocline, peristome thickened, complete, with internal rim on columellar side.

Discussion. This species is placed in the genus *Skenea* Fleming, 1825, although it is far more solid and lenticular than *Skenea dautzenbergi* (Glibert, 1949), *S. serpuloides*



Figures 1–7. Gastropods from the Lower Piacenzian, Upper Pliocene, El Lobillo, Estepona, Andalusia, south-western Spain. **1a–d.** *Skeneea dautzenbergi* (Glibert, 1949), maximum diameter 1.5 mm, height 0.9 mm (SEM images). **2a–d.** *Skeneea gofasi* spec. nov., holotype, maximum diameter 1.4 mm, height 0.8 mm, protoconch diameter 0.31 mm (SEM images). **3a–c.** *Skeneoides exilissima* (Philippi, 1844), maximum diameter 0.9 mm (SEM images). **4a, b.** *Mareleptopoma minor* (Almera & Bofill, 1898), height 1.1 mm, width 0.9 mm (SEM images). **5a, b.** *Eatonina ochroleuca* (Brusina, 1869), height 0.68 mm, width 0.53 mm (digital images). **6a, b.** *Eatonina pumila* (Monterosato, 1884), height 650 µm, width 515 µm (digital images). **7a–d.** *Papuliscala spinosa* spec. nov., holotype, height 5.4 mm, width 2.1 mm (SEM images), protoconch maximum diameter 0.29 mm, height 0.28 mm.

(Montagu, 1808) or *S. giemellorum* Romani, Bogi & Bartolini, 2015. In shape and shell thickness it is reminiscent of members of the genus *Leucorhynchia* Crosse, 1867, but in that genus, there is a spur or thickening developed at the umbilical margin. The most similar European species is *Skenea pelagia* Nofroni & Valenti, 1987 from the present-day western and central Mediterranean (Giannuzzi-Savelli, 1994: 104). In that species the ribs diverge or radiate outwards from the umbilicus obliquely (Nofroni & Valenti, 1987: 6, figs 3, 5), whereas in *S. gofasi* spec. nov. the cords are concentric and horizontal. *Skenea olgae* Segers, Swinnen & De Prins, 2009 from present-day Madeira is similar in sculpture, but is smaller, thinner-shelled, the aperture is less symmetrically round, and the spiral cords on the base are coarser.

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

Genus *Skeneoides* Warén, 1992

Skeneoides Warén, 1992: 156. Type species (by original designation): *Delphinula exilissima* Philippi, 1844, present-day, Italy.

Skeneoides exilissima (Philippi, 1844)

Figure 3a–c

Delphinula exilissima Philippi, 1844: 224, pl. 28 fig. 2.

Cyclostrema dautzenbergianum Ancey, 1898: 54.

Cyclostrema subalveolatum Fekih & Gougerot, 1977: 229, pl. 1 figs 6, 7.

Skenea exilissima (Philippi, 1844)—Van Aartsen et al., 1984: 12, fig. 38.

Skeneoides exilissima (Philippi, 1844)—Warén, 1992: 156, figs 5B, 8D–H, 9B.

Skeneoides exilissima (Philippi, 1844)—Giannuzzi-Savelli et al., 1997: 110, fig. 367.

Skeneoides exilissima (Philippi, 1844)—Peñas et al., 2006: figs 47–49.

Skeneoides exilissima (Philippi, 1844)—Nofroni & Renda, 2021: 844, fig. 4.

Material and dimensions. NHMW2022/0070/0012, maximum diameter 860 µm (EL 1).

Discussion. *Skeneoides exilissima* (Philippi, 1844) is closely similar to *S. formosissima* (Brugnone, 1873) from the present-day Mediterranean, but the latter differs in having stronger axial ribs. Nofroni & Renda (2021: 845) discussed the difficulty of assigning juveniles to one or other species and questioned whether they were extreme forms of a single species. In any case, the Estepona specimen has regular and rather weakly reticulated sculpture and is typical for *S. exilissima*. This is the first fossil record for the species. Unfortunately, the specimen was damaged during handling for SEM microscopy.

Distribution. Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: western Mediterranean (Van Aartsen et al., 1984; Warén, 1992; Giannuzzi-Savelli et al., 1997; Peñas et al., 2006), central Mediterranean (Nofroni & Renda, 2021).

Superfamily Cerithioidea Fleming, 1822

Family Pickworthiidae Iredale, 1917

Genus *Mareleptopoma* Moolenbeek & Faber, 1984

Mareleptopoma Moolenbeek & Faber, 1984: 98. Type species (by original designation): *Mareleptopoma karpatensis* Moolenbeek & Faber, 1984, present-day, Caribbean.

Mareleptopoma minor (Almera & Bofill, 1898)

Figure 4a, b

Danilia tinei var. *minor* Almera & Bofill, 1898: 90, pl. 6 fig. 17.

Sansonia italica Raffi & Taviani, 1985: 281, figs 2–3.

Mareleptopoma italica (Raffi & Taviani)—Ardevini & Cosignani, 2004 (*partim*): 24, 89 unnumbered fig. (only fossil record illustrated).

Mareleptopoma italica (Raffi & Taviani, 1985)—Rolán, 2005b: 2, figs 1–5, 11–13, 18, 20.

Mareleptopoma minor (Almera & Bofill, 1898)—Landau & Fortea, 2006: 57, pl. 1 fig. 1.

Mareleptopoma minor (Almera & Bofill, 1898)—Sosso et al., 2008: 14, fig. 1a–g.

Mareleptopoma minor (Almera & Bofill, 1898)—Sosso & Dell'Angelo, 2010: 29, 37 unnumbered fig. 3rd row right.

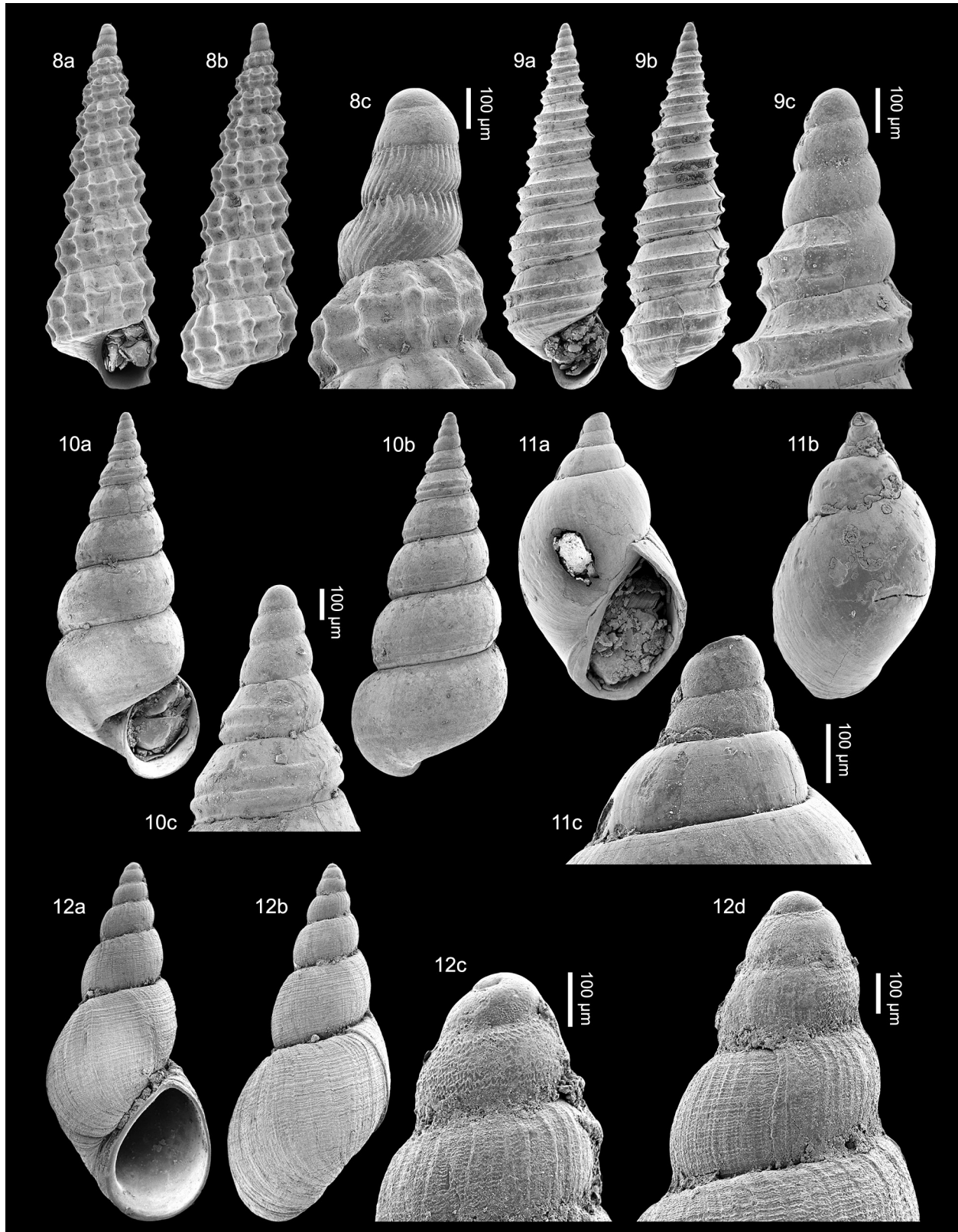
Mareleptopoma minor (Almera & Bofill, 1898)—Brunetti & Cresti, 2018: 66, fig. 225.

non Sansonia italica Raffi & Taviani, 1985—Rolán, 1991: 43 (= *Mareleptopoma defluxa* Rolán, 2005).

non Mareleptopoma aff. *italica* (Raffi & Taviani, 1985)—Rolán, 2005a: 75, figs 281, 315 (= *Mareleptopoma defluxa* Rolán, 2005).

Material and dimensions. NHMW2022/0070/0004, height 1.1 mm, width 930 µm (EL 1); NHMW2022/0070/0005 (6).

Discussion. In stark contrast to its minute size, *Mareleptopoma minor* (Almera & Bofill, 1898) has probably had the largest volume of papers published dedicated specifically to it of any European Pliocene gastropod species. Extant records from the Cape Verde Islands were later described as a separate species: *Mareleptopoma defluxa* Rolán, 2005. Sosso et al. (2008) showed *M. minor* to be quite widespread in Lower Pliocene Zanclean Italian assemblages, with fewer records from the Upper Pliocene Piacenzian. Herein we extend the range of the species in the Pliocene to the westernmost Mediterranean, adjacent to the Strait of Gibraltar. *Mareleptopoma minor* was first collected from a bathyal



Figures 8–12. Gastropods from the Lower Piacenzian, Upper Pliocene, El Lobillo, Estepona, Andalusia, south-western Spain. **8a–c.** *Narimannia saludubensis* spec. nov., holotype, height 4.3 mm, width 1.3 mm (SEM images), protoconch maximum diameter 0.29 mm, height 0.49 mm. **9a–c.** *Aclis cellinii* Chirli, 2009, NHMW2022/0070/0018, height 4.3 mm, width 1.2 mm (SEM images). **10a–c.** *Aclis minor* (T. Brown, 1827), height 3.7 mm, width 1.5 mm (SEM images). **11a–c.** *Ophieulima lobilloensis* spec. nov., holotype, height 1.4 mm, width 820 µm (SEM images), protoconch maximum diameter 0.20 mm, height 0.18 mm (incomplete). **12a–d.** *Talassia plioalboranensis* spec. nov., holotype, height 3.9 mm, width 1.6 mm (SEM images), protoconch maximum diameter 0.29 mm, height 0.67 mm.

Piacenzian sequence at Campore (Parma, Italy) (Raffi & Taviani, 1985). However, in Estepona we have only found it in the relatively shallow water assemblage of El Lobillo.

Distribution. Lower Pliocene: western Mediterranean, north-eastern Spain (Almera & Bofill, 1988); central Mediterranean, Italy (Sosso et al., 2008; Sosso & Dell'Angelo, 2010; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Raffi & Taviani, 1985; Sosso et al., 2008).

Superfamily Cingulopsoidea Fretter & Patil, 1958
Family Cingulopsidae Fretter & Patil, 1958

Genus *Eatonina* Thiele, 1912

Eatonina Thiele, 1912: 279. Type species (by monotypy):
Eatoniella pusilla Thiele, 1912, present-day, South Africa.

***Eatonina ochroleuca* (Brusina, 1869)**

Figure 5a, b

Setia ochroleuca Brusina, 1869: 247.

Eatonina (Coriandria) ochroleuca (Brusina, 1869)—Amati, 1987: 37, figs 6, 11.

Eatonina ochroleuca (Brusina, 1869)—Cachia et al., 1996: 38, pl. 2 fig. 4.

Eatonina (Coriandria) ochroleuca (Brusina, 1869)—Giannuzzi-Savelli et al., 1996: 70, figs 182, 183.

Material and dimensions. NHMW2022/0070/0009, height 675 µm, width 525 µm (EL 1); NHMW2022/0070/0010 (20).

Discussion. *Eatonina ochroleuca* (Brusina, 1869) is characterised by its colour pattern of poorly defined rounded blotches around the periphery of the last whorl and a row of smaller spots just below the suture. It is easily separated from *E. pumila* (Monterosato, 1884) with which it co-occurs in the El Lobillo deposits that has colour bands. The last whorl in *E. ochroleuca* is angularly rounded at the periphery; *E. pumila* is evenly rounded.

Distribution. Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Lower Pleistocene: central Mediterranean, Sicily (Amati, 1987). Present-day: entire Mediterranean (Amati, 1987; Cachia et al., 1996; Giannuzzi-Savelli et al., 1996).

***Eatonina pumila* (Monterosato, 1884)**

Figure 6a, b

Setia pumila Monterosato, 1884: 74.

Eatonina (Coriandria) pumila (Monterosato, 1884)—Amati, 1987: 35, figs 4, 9.

Eatonina (Coriandria) pumila (Monterosato, 1884)—Verduin, 1988: 17, figs 6, 11, 16.

Eatonina (Coriandria) pumila (Monterosato, 1884)—Rubio & Rodríguez Babío, 1996: 27, fig. 2.

Eatonina (Coriandria) pumila (Monterosato, 1884)—Giannuzzi-Savelli et al., 1996: 72, figs 188, 189.

Material and dimensions. NHMW2022/0070/0006, height 650 µm, width 515 µm (EL 1); NHMW2022/0070/0007 (20).

Discussion. *Eatonina pumila* (Monterosato, 1884) is characterised by having a colour pattern on the last whorl consisting of three narrow orange-brown spiral bands of equal width. This separates it from *E. fulgida* (J. Adams, 1797), which although similar in size and shape and although rather variable in colour pattern, has broader colour bands including usually a very broad mid-whorl band. *Eatonina ordofasciarum* Rolán & Hernández, 2006 from present-day West Africa also has similar colouration, but has four narrow band: two placed on the adapical ½ of the last whorl, two running over the base, the most abapical delimiting the umbilicus.

Distribution. Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper). Present-day: Atlantic, eastern Mediterranean (Verduin, 1988; Rubio & Rodríguez Babío, 1996), central Mediterranean (Verduin, 1988; Giannuzzi-Savelli et al., 1996), not present in eastern Mediterranean (Amati, 1987).

Superfamily Epitonoidea Berry, 1910 (1812)
Family Epitoniidae Berry, 1910 (1812)

Genus *Papuliscala* de Boury, 1911

Papuliscala de Boury, 1911: 220. Type species (by original designation): *Acirsa praelonga* Jeffreys, 1877, present-day, deep water, north-eastern Atlantic.

***Papuliscala spinosa* spec. nov.**

Figure 7a–d

ZooBank registraton. urn:lsid:zoobank.org:act:9A90D894-D9C9-4A47-86E3-F2FC93A51941

Type material. Holotype NHMW2022/0070/0011, height 5.4 mm, width 2.1 mm.

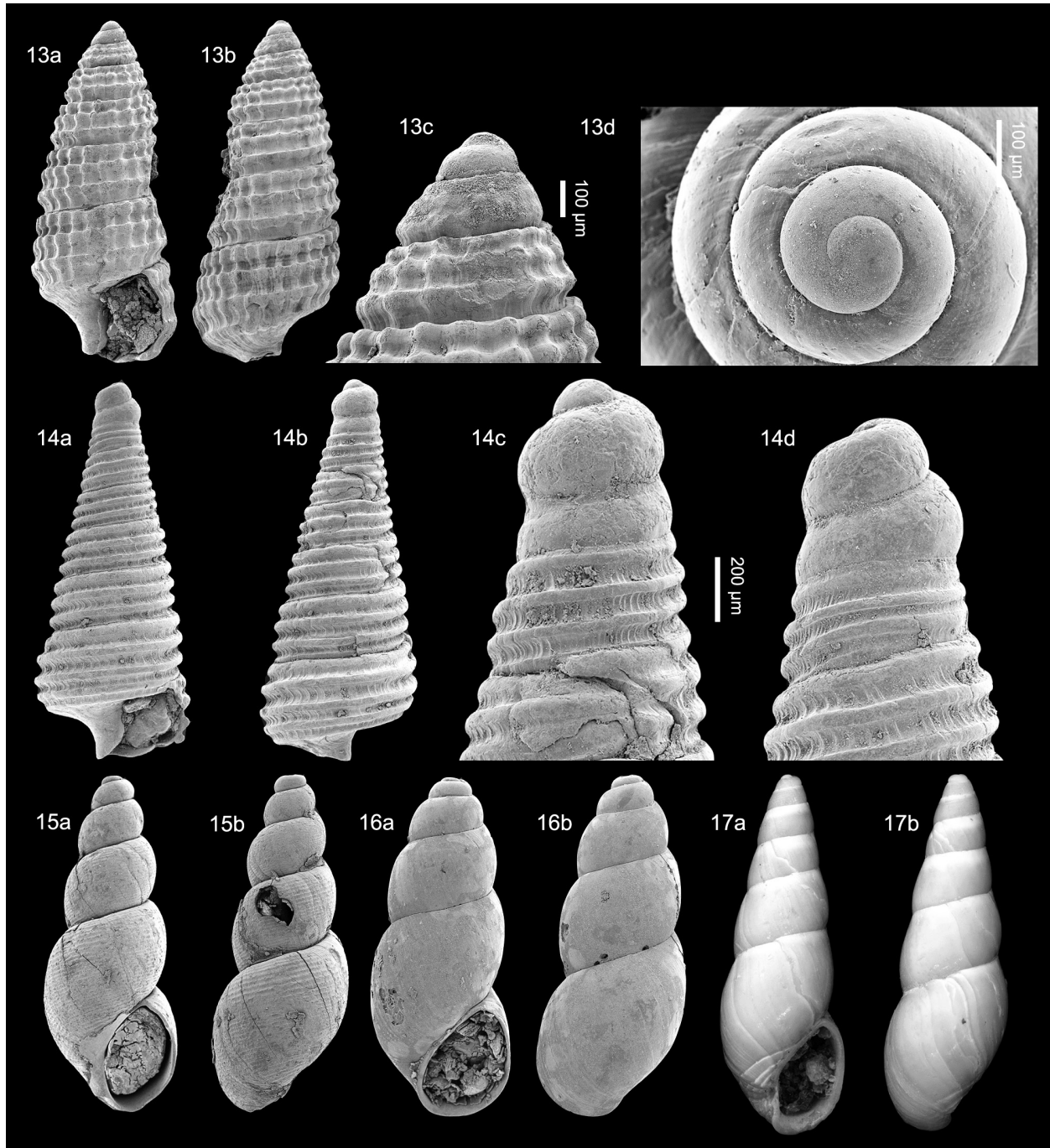
Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Named reflecting the spinose sculpture. *Papuliscala* gender feminine.

Diagnosis. *Papuliscala* species with paucispiral protoconch bearing axial riblets, raised conical profile, teleoconch bearing axial ribs and two strong spiral cords per whorl, with prominent spinous tubercles developed at intersections.



Figures 13–17. Gastropods from the Lower Piacenzian, Upper Pliocene, Estepona, Andalusia, S. Spain: 13–16 from El Lobillo; 17 from Velerín sands, Velerín. **13a–d.** *Specula estebunensis* spec. nov., holotype, height 2.7 mm, width 1.1 mm (SEM images), protoconch maximum diameter 0.30 mm, height 0.26 mm. **14a–d.** *Seila trilineata trilineata* (Philippi, 1836), height 3.9 mm, width 1.6 mm (SEM images). **15a, b.** *Ceratia proxima* (Forbes & Hanley, 1850), height 3.7 mm, width 1.5 mm (SEM images). **16a, b.** *Hyala vitrea* (Montagu, 1803), height 3.0 mm, width 1.2 mm (SEM images). **17a, b.** *Rhombostoma carmelae* (Brugnone, 1873), height 4.9 mm, width 1.6 mm (digital images).

Description. Shell small (height 5.4 mm, width 2.1 mm), profile raised, conical. Protoconch paucispiral, of just under two whorls; first whorl smooth, second whorl convex with close-set, orthocline riblets, suture shallow (maximum diameter 0.29 mm, height 0.28 mm). Protoconch boundary sharply delimited by scar. Teleoconch of 5½ convex whorls

separated by deeply impressed suture. Sculpture of about 20 rounded prosocline ribs extending between sutures and two prominent spiracine ribs extending between sutures and two prominent spiral cords on spire whorls, with third cord at abapical suture on penultimate whorl. Prominent spinous tubercles at sculptural intersections. Last whorl convex, with three tubercular cords, abapical cord delimiting base;

base slightly concave, imperforate. Aperture ovate, outer lip not thickened, with small spout-like siphonal expansion abapically. Columella thickened with moderate callus rim.

Discussion. Although represented by a single specimen, this species is so distinctive it warrants formal description. Placement in the deep-water north-western Atlantic genus *Papuliscala* is based on the protoconch type and sculpture, shell profile and cancellate sculpture. The teleoconch sculpture is close to the genus *Iphitus* Jeffreys, 1883, but species in that genus have a tall, multispiral, subcylindrical (planktotrophic) protoconch and teleoconch with few whorls quickly increasing in size with very regular sculpture. The new species has a protoconch with a short lecithotrophic phase and the teleoconch with a conical outline with more than four whorls.

Papuliscala spinosa spec. nov. is immediately separated from its extant congeners (Bouchet & Warén, 1986; Hoffman et al., 2020) by the elevated spinous tubercles developed at the sculptural intersections. *Papuliscala tavianii* Bouchet & Warén, 1986 from the present-day Sicilian Channel and the Canaries has a similar reticulated sculpture but is immediately separated by its more elongated profile and the tubercles at the sculptural intersections are not spinous. *Papuliscala seamountae* Hoffman, Gofas & Freiwald, 2020 from the Azorean seamounts is similar in sculpture and in having a squatter shell than usual for the genus, but again does not develop spinous tubercles.

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

Genus *Narrimania* Taviani, 1984

Narrimania Taviani, 1984: 240. Type species (by original designation): *Cerithiopsis concinna* Sykes, 1925, present-day, Mediterranean.

Narrimania saldubensis spec. nov.

Figure 8a–c

ZooBank registraton. urn:lsid:zoobank.org:act:D0BAF545-D901-4C5A-A270-7338944CD993

Type material. Holotype NHMW2022/0070/0015, height 4.3 mm, width 1.3 mm.

Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Name after the old Roman name for Estepona, Salduba. *Narrimania* gender feminine.

Diagnosis. Highly raised conical species with multispiral protoconch, first 1½ whorls smooth, later with crowded sinuous axial riblets, teleoconch with coarse reticulated sculpture composed of 12 ribs and two spiral cords per whorl, forming small tubercles at sculptural intersections,

base delimited by prominent peribasal cord, no surface microsculpture.

Description. Shell small (height 4.3 mm, width 1.2 mm), of medium thickness, elongate-turriculate, with coarse reticulate sculpture, suture shallow. Protoconch composed of about four whorls, first 1½ whorls smooth, subsequent whorls slightly swollen in abapical half, bearing sculpture of numerous, close-set, rounded, sinuous opisthocline riblets, wider than their interspaces: exposed height 0.49 mm, maximum width 0.29 mm. Protoconch/teleoconch boundary sharply delimited. Teleoconch of 7½ convex whorls, with periphery at abapical cord. Suture narrowly impressed. Axial sculpture of elevated prosocline rounded ribs, 12 on penultimate whorl, about ½ the width of their interspaces. Spiral sculpture of two rounded cords, slightly weaker than ribs and narrower than their interspaces, third cord appearing at abapical suture on penultimate whorl, forming small, rounded tubercles at intersections. No surface microsculpture present. Last whorl convex. Base flattened, sharply angled, strongly delimited by prominent peribasal cord, bearing one subobsolete cord abapically. Aperture subovate, outer lip simple, angular at the basal cord.

Discussion. Although the teleoconch profile and sculpture of this new species is similar to that of species in the genus *Papuliscala* de Boury, 1911 (see above), it differs in having a multispiral protoconch. The protoconch sculpture is similar to that seen in the genus *Narrimania* Taviani, 1984, in which we tentatively place this species. *Opaliopsis* Thiele, 1928 also has a similarly sculptured protoconch, but has a strongly varicose outer lip, not seen in the new species.

Narrimania saldubensis spec. nov. is most similar to *N. concinna* (Sykes, 1925) from the present-day Mediterranean, but differs in its slenderer elongate profile, the teleoconch composed of taller, less convex, and more numerous whorls.

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

Superfamily Vanikoroidea Gray, 1840

Family Eulimidae Philippi, 1853

Genus *Aclis* Lovén, 1846

Aclis Lovén, 1846: 148. Type species (by monotypy): *Alvania supranitida* Wood, 1842 [= *Aclis minor* (Brown, 1827)], Pliocene, British Isles.

Aclis cellinii Chirli, 2009

Figure 9a–c

Aclis penetrans Sosso, 1999—Chirli & Bogi, 2002: 20, pl. 1 fig. 10 (*non* Sosso, 1999).

Aclis verduini Van Aartsen, Menkhorst & Gittenberger, 1984—Landau et al., 2006: 58, pl. 17 figs 13, 14 (*non* Van Aartsen, Menkhorst & Gittenberger, 1984).

Aclis cellinii Chirli, 2009: 74, pl. 30 figs 10–15, pl. 31 figs 1–5.

Material and dimensions. NHMW2022/0070/0018, height 4.3 mm, width 1.2 mm (EL 1).

Discussion. Landau et al. (2006: 58, pl. 17 figs 13, 14) initially identified their incomplete specimens, missing their protoconch, as *Aclis verduini* Van Aartsen, Menkhorst & Gittenberger, 1984. That species, described as an extant paucispiral species endemic to the Alboran Sea, is now considered a junior subjective synonym of *A. trilineata* Watson, 1897 that has a wider distribution including Madeira, Selvagen Islands, southern Iberian Peninsula and Canary Islands (Rolán et al., 2006: 88; Hernández et al., 2011: 99). The illustrated specimen has a multispiral protoconch. Chirli (2009: 75) was therefore correct to suspect that the Estepona specimens represented his new taxon, *A. cellinii*. It differs from *A. ascaris* (Turton, 1819) in being larger, slenderer, with less convex whorls, and only having two cords at the beginning of the teleoconch (three in *A. ascaris*). *Aclis proascaris* Sacco, 1891 and *A. penetrans* Sosso, 1999, both from the Italian Pliocene, differ in having more numerous spiral cords.

Distribution. Lower Pliocene: central Mediterranean, Italy (Chirli & Bogi, 2002; Chirli, 2009). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Landau et al., 2006).

***Aclis minor* (T. Brown, 1827)**

Figure 10a–c

Turritella minor T. Brown, 1827: 57.

Aclis supranitida Wood—Cerulli-Irelli, 1914: 243 [417], pl. 21 [53] figs 37–41.

Aclis minor (Brown, 1827)—Rasmussen, 1968: 105, pl. 8 fig. 6, pl. 10 figs 3, 4.

Aclis minor (Brown)—Moths, 1989: 134, pl. 11 fig. 52.

Aclis minor (Brown, 1827)—Schnetler, 2005: 97, pl. 5 fig. 14.

Aclis minor (Brown, 1827)—Landau et al., 2006: 57, pl. 17 figs 10–12 (*cum syn.*).

Aclis minor (Brown, 1827)—Chirli, 2009: 75, pl. 31 figs 6–10.

Aclis minor (Brown, 1827)—Chirli & Linse, 2011: 100, pl. 29 fig. 2.

Aclis minor (Brown, 1827)—Brunetti & Cresti, 2018: 62, fig. 196.

Material and dimensions. NHMW2022/0070/0008, height 3.7 mm, width 1.5 mm (EL 1).

Discussion. Landau et al. (2006: pl. 17 figs 10–12) figured incomplete specimens from the Velerín carretera deposits with spiral sculpture well developed until the last whorl. Here we illustrate a complete specimen with spiral sculpture developed only on the early teleoconch whorls, similar to those figured by Fretter & Graham (1982, fig 283 middle and right specimens), illustrating the wide range of spiral sculpture seen in this species.

Distribution. Upper Miocene: North Sea Basin, Denmark (Rasmussen, 1968; Schnetler, 2005), Germany (Moths, 1989). Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1842, 1848; Harmer, 1925); central Mediterranean, Italy (Chirli, 2009; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Landau et al., 2006). Lower Pleistocene: North Sea Basin England, Ireland (Harmer, 1925); central Mediterranean, Italy (Cerulli-Irelli, 1914); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Present-day: Norway to Madeira into the Mediterranean and Adriatic, 2–250 m depth, coral-ligenous and pre-coral-ligenous, sandy, or muddy bottoms (Albanesi et al., 1981).

Genus *Ophieulima* Warén & Sibuet, 1981

Ophieulima Warén & Sibuet, 1981: 107. Type species (by original designation): *Stilifer minima* Dall, 1927, present-day, Georgia, USA.

***Ophieulima lobilloensis* spec. nov.**

Figure 11a–c

ZooBank registraton. urn:lsid:zoobank.org:act:0755FA D7-6ACC-43A0-9435-FBD89E572B43

Type material. Holotype NHMW2022/0070/0016, height 1.4 mm, width 820 µm.

Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Name after the type locality of El Lobillo, Estepona. *Ophieulima* gender feminine.

Diagnosis. *Ophieulima* species with elongate ovate profile, convex whorls, pupiform protoconch of at least 2½ whorls, teleoconch with fine, widely spaced spiral grooves, imperforate, but with small, flattened ledge in umbilical area.

Description. Shell small (height 1.4 mm, width 0.8 mm), moderately convex and solid. Protoconch conical, composed of at least 2½ whorls (nucleus and first whorl abraded; maximum diameter 0.20 mm, height 0.18 mm—incomplete), suture shallow impressed. Teleoconch of 2½ convex whorls bearing very fine, widely spaced grooves, three on penultimate whorl. Last whorl 80% of total height, evenly convex, with fine grooves over entire surface, slightly closer spaced than on penultimate whorl; imperforate, but with small flattened periumbilical ledge. Aperture large, pyriform, 50% of total height, outer lip simple, convex. Columella straight, slanting abaxially. Inner lip callus forming narrow margin, slightly thickened abapically.

Discussion. Generic placement in *Ophieulima* Warén & Sibuet, 1981 is based on its multispiral pupiform protoconch and relatively inflated last whorl. The eulimid genera

Pelseeneria Koehler & Vaney, 1908 and *Stilapex* Iredale, 1925 differ in having an even more inflated last whorl and a protoconch of less than two whorls (Bouchet & Warén, 1986: 347). Moreover, *Pelseeneria* species are thinner shelled.

Ophieulima minima (Dall, 1927) from the present-day Bay of Biscay to southern Iceland and the West Atlantic differs in having a more convex last whorl. It also has spiral sculpture but composed of rather irregular and closer spaced scratch-like grooves rather than the regular widely spaced grooves seen in *Ophieulima lobilloensis* spec. nov. (Fig. 11c).

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

Family Vanikoridae J.E. Gray, 1840

Genus *Talassia* Warén & Bouchet, 1988

Talassia Warén & Bouchet, 1988: 93. Type species (by original designation): *Rissoa? coriacea* Manzoni, 1868, Recent, upper shelf, Madeira.

Talassia plioalboranensis spec. nov.

Figure 12a–d

ZooBank registraton. urn:lsid:zoobank.org:act:535320C8-1203-4439-950F-9077CC0BDF93

Type material. Holotype NHMW2022/0070/0017, height 3.9 mm, width 1.6 mm.

Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Name after the Pliocene Alboran Sea. *Talassia* gender feminine.

Diagnosis. Raised conical outline with rounded apex, rissoiform, small size (height 3.9 mm, width 1.6 mm, protoconch of 2½ whorls with cruciform tubercular microsculpture, teleoconch of 4½ whorls bearing fine sculpture of fine sinuous lamellar ribs crossed by crowded spiral threads, large aperture bordered by thickened peristome, small umbilical chink.

Description. Shell small, of medium thickness, rissoiform. Protoconch tall dome-shaped, composed of 2½ convex whorls bearing microsculpture of very irregularly spiral rows of cruciform tubercles (maximum diameter 0.29 mm, height 0.67 mm). Protoconch/teleoconch boundary marked by beginning of adult sculpture. Teleoconch of 4½ convex whorls, deep suture. Sculpture on first teleoconch whorl of low, sinuous, lamellar ribs overrun by very fine, crowded spiral threads. Ribs weaken on second whorl, subobsolete abapically, where axial sculpture consists of axial growth lines of irregular strength. Last whorl 65% of total height, convex, growth lines most evident below suture and at very

narrow umbilical chink. Aperture large, pyriform, 37% of total height, peristome complete; outer lip well rounded and somewhat expanded abapically. Columella curved, straightened towards parietal area, smooth, slanting abaxially. Columellar callus narrow, thickened, slightly elevated, and detached from venter, forming medial border of narrow umbilical chink.

Discussion. This new species is placed in the genus *Talassia* Warén & Bouchet, 1988 based on its similarity with the type species *Talassia coriacea* (Manzoni, 1868), sculpture of low sinuous axial lamellae, and very narrow umbilical chink.

Talassia species are variable in outline and teleoconch sculpture. The new fossil species differs from all the extant deep-water Atlantic and Mediterranean species (Warén & Bouchet, 1988: figs 44–48; Hoffman & Freiwald, 2022) by its tall protoconch with complex sculpture and less so the teleoconch sculpture. All extant species off the European and north-western African continent have many spirals of finely aligned dots; all north-western Atlantic, Mauritanian and Angolan deep-water species have a predominantly smooth protoconch (Hoffman & Freiwald, 2022). The most similar are *T. tenuisculpta* (Watson, 1873) in which the axial lamellae are also weak, and absent on the later adult whorls, but the protoconch in that species is bulbous, of 1½ whorls, the last ½ whorl bearing fine filiform spirals, the teleoconch whorls are lower, and the columella less thickened, and *T. sandersoni* (Verrill, 1884) from the West Atlantic that has a small, smoother protoconch (Hoffman & Freiwald, 2022: figs 12–21). It seems, therefore, that the extant species have developed a shorter lecitotrophic phase or possibly direct development (*T. laevapex* Hoffman & Freiwald, 2022).

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

Superfamily Triphoroidea Gray, 1847

Family Cerithiopsidae H. Adams & A. Adams, 1853

Subfamily Cerithiopsinae H. Adams & A. Adams, 1853

Genus *Specula* Finlay, 1926

Specula Finlay, 1926: 382, 385. Type species (by original designation): *Cerithiopsis styliformis* Suter, 1908, present-day, New Zealand.

Specula estebunensis spec. nov.

Figures 13a–d

ZooBank registraton. urn:lsid:zoobank.org:act:4AA7A279-12FE-4CA0-9732-799FAC61013C

Type material. Holotype NHMW2022/0070/0021, height 2.7 mm, width 1.1 mm.

Other material. Known from holotype only.

Type locality. El Lobillo, Estepona, Andalusia, S. Spain.

Type stratum. Unnamed beds of Lower Piacenzian age, Upper Pliocene.

Etymology. Name after the type locality of Estepona. *Specula* gender feminine.

Diagnosis. *Specula* species with cyrtoconoid profile, low dome-shaped protoconch of about two smooth whorls, teleoconch with three spiral cords, all three appearing simultaneously at protoconch/teleoconch junction, about 20 weaker axial ribs forming tubercles at intersections, last whorl with prominent peribasal cord, base smooth.

Description. Shell small, cyrtoconoid. Protoconch low dome-shaped, consisting of two smooth whorls (maximum diameter 0.30 mm, height 0.26 mm). Teleoconch of five weakly convex whorls separated by deeply impressed suture. Sculpture of three spiral cords; all three appear simultaneously at protoconch/teleoconch junction, spiral 1 initially weaker, strengthening abapically to become equal in strength to other spirals by fourth teleoconch whorl. Spirals 1 and 2 slightly closer spaced than spiral 3. Axial sculpture of about 20 orthocline ribs, weaker than cords, forming regular reticulated surface pattern, with strong, rounded tubercles formed at sculptural intersections. Last whorl weakly convex, with three tuberclose spiral cords and prominent smooth peribasal cord delimiting concave base, peribasal cord weakly tubercular towards aperture, base smooth, except for growth lines. Aperture small, subquadrate, outer lip simple, siphonal canal short. Columellar and parietal callus forming narrow callus margin.

Discussion. The shell characters are similar to those described by Marshall (1978: 76) for the cerithiopsid genus *Specula* Finlay, 1926, characterised by shells with a paucispiral non-planktotrophic protoconch of 1–2¾ smooth, convex whorls, with or without a submedial angulation, shoulder riblets on the last ½ whorl, broad, shallow sinusigera, teleoconch of reticulated sculpture composed of three cords on spire whorls, with tubercles formed at the sculptural intersections, and a smooth base. It is currently solely known from the Pacific (e.g., Cecalupo & Perugia, 2013, 2017, 2018, 2019, 2021).

Specula estebunensis spec. nov. is separated from all extant cerithiopsid Mediterranean taxa illustrated by Giannuzzi-Savelli et al. (1999: figs 29–68) and Rolán et al. (2006: figs 85–117), by its low dome-shaped paucispiral protoconch. This is the first record for the genus in the European faunas.

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

Subfamily Seilinae Golikov & Starobogatov, 1975

Genus *Seila* A. Adams, 1861

Seila A. Adams, 1861: 131. Type species (by subsequent designation, Dall, 1889): *Triphoris dextroversus* A. Adams & Reeve, 1850, present-day, China Sea.

Seila trilineata trilineata (Philippi, 1836)

Figure 14a–d

Cerithium trilineatum Philippi, 1836: 163.

Seila trilineata (Philippi, 1836)—Tembrock, 1964: 330, pl. 5 fig. 1.

Seila trilineata (Philippi, 1836)—Rolán & Fernandes, 1990: 20, fig. 22.

Seila trilineata (Philippi, 1836)—Giannuzzi-Savelli et al., 1999: 15, 46, figs 88–91.

Seila (Cinctella) trilineata trilineata (Philippi, 1836)—Marquet, 2001: 198, pl. 1 fig. 1.

Seila trilineata (Philippi, 1836)—Chirli & Linse, 2011: 111, pl. 32 fig. 2.

non *Cerithium trilineatum* Phil.—Wood, 1848: 70, pl. 8 fig. 4 [= *Seila suttonensis* Marquet, 2001].

non *Cerithium trilineatum* Phil.—Hörnes, 1855: 413, pl. 42 fig. 19 [= *Seila turritissima* Sacco, 1895].

non *Newtoniella (Seila) trilineata* (Philippi)—Harmer, 1918: 424, pl. 41 fig. 24 [= *Seila suttonensis* Marquet, 2001].

non *Seila (Seila) trilineata* Philippi, 1836—Glibert, 1949: 155, pl. 10 fig. 10 [= *Seila trilineata andegavensis* Marquet, 2001].

non *Seila trilineata* (Philippi, 1836)—van Regteren Altena et al., 1955: 30, pl. 6 fig. 65 [= *Seila suttonensis* Marquet, 2001].

non *Seila trilineata* Philippi, 1836—Strausz (partim), 1955: 209, pl. 10 fig. 181 only [= *Seila turritissima* Sacco, 1895].

non *Seila trilineata* Philippi, 1836—Brébion, 1964: 250 [Miocene specimens = *Seila trilineata andegavensis* Marquet, 2001; Pliocene specimens = *Seila suttonensis* Marquet, 2001].

non *Seila trilineata* Philippi—Csepregy-Meznerics, 1950: 21, pl. 3 figs 28, 29 [= *Seila turritissima* Sacco, 1895].

non *Seila (Seila) trilineata* (Philippi, 1836)—Bařuk, 1975: 166, pl. 20 figs 8–11 [= *Seila turritissima* Sacco, 1895].

non *Seila trilineata* (Philippi, 1836)—Marquet, 1997: 83, pl. 5 fig. 3 [= *Seila suttonensis* Marquet, 2001].

non *Seila trilineata* (Philippi, 1836)—Marquet, 1998: 110, fig. 84 [= *Seila suttonensis* Marquet, 2001].

Material and dimensions. NHMW2022/0070/0014, height 3.9 mm, width 1.6 mm (EL 1), VS (fide Marquet, 2001: 199, table 2).

Discussion. *Seila trilineata trilineata* (Philippi, 1836) is characterised by its protoconch of about two whorls, two primary spiral cords at the appear at the protoconch/teleoconch junction, the adapical cord appears ½ whorl later, abapically sculpture of three cords, equal in strength and spacing, with fine axial lamellae present in the spiral interspaces.

As noted by Rolán & Fernandes (1990: 20), its paucispiral protoconch suggests either direct development or a short planktotrophic phase, and those authors suggested that *S. trilineata* in the extant faunas might be restricted to the Mediterranean. Similarly in the fossil assemblages,

most records for *S. trilineata* do not refer to that species. The Paratethyan specimens and those from the Middle Miocene Proto-Mediterranean of Turkey have a tall multi-spiral protoconch and refer to *Seila turritissima* Sacco, 1895 (see Landau et al., 2013). Marquet (2001) separated the Middle and Upper Miocene specimens from the Atlantic of north-western France as the subspecies *Seila trilineata andegavensis* Marquet, 2001 (for further discussion see Marquet, 2012: 198 and Landau et al., 2018: 241). Marquet (2001) also noted that the Pliocene North Sea Basin specimens identified as *S. trilineata* had a quite different protoconch and erected the species *S. suttonensis* Marquet, 2001 (see Van Dingenen et al., 2016: 163). *Seila plioiberica* Landau, La Perna & Marquet, 2006 described from the Estepona assemblages differs immediately in having a depressed protoconch of only one whorl, two cords are present at the protoconch/teleoconch boundary, the adapical cord appearing one whole whorl later. We have excluded the Middle and Upper Miocene varieties from Italy described by Sacco (1895a: 73) as their illustrations are insufficient to adequately characterise them. Marquet (2001: 198) also doubted that these Miocene records were conspecific.

For comparison with extant congeners, see Rolán & Fernandes (1990: 26–27, tables 1, 2).

Distribution. Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Marquet, 2001). Lower Pleistocene: eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Present-day: Mediterranean (Rolán & Fernandes, 1990), Sicily (Tembrock, 1964; Marquet, 2001). Records from Cape Verde Islands are based on misidentifications.

Superfamily Truncatelloidea J.E. Gray, 1840

Family Irvadiidae Thiele, 1924

Genus *Ceratia* H. Adams & A. Adams, 1852

Ceratia H. Adams & A. Adams, 1852: 359. Type species (by monotypy): *Rissoa proxima* Forbes & Hanley, 1850, present-day, British Isles.

Ceratia proxima (Forbes & Hanley, 1850)

Figure 15a, b

Rissoa striatula Jeffreys, 1847: (non Eichwald, 1830).

Rissoa proxima Alder ms. Thompson, 1847: 174 (nomen nudum).

Rissoa proxima (ex Alder ms.) Forbes & Hanley, 1850: 127, pl. 75 figs 7, 8.

Rissoa striatissima de Rayneval & Ponzi, 1854: 17.

Rissoa proxima Alder—Wood, 1874: 71, pl. 4 fig. 17.

Rissoa (*Ceratia*) *proxima* Alder—Cerulli-Irelli, 1914: 196 [370], pl. 15 [47] figs 58–62.

Ceratia cf. *proxima* (Alder)—Cossmann, 1921: 45, pl. 2 figs 40, 41.

Ceratia proxima (Alder MS.)—Harmer, 1923: 644, pl. 51 fig. 41.

Cingula (*Cingula*) *proxima* (Forbes & Hanley, 1850)—Pelo-sio, 1960: 139, pl. 1 fig. 6.

Cingula (*Cingula*) *proxima* (Forbes & Hanley, 1850)—Anderson, 1960: 20, pl. 2 fig. 5.

Onoba proxima (Forbes & Hanley, 1850)—Fretter & Graham, 1978: 167, figs 141, 142.

Ceratia proxima (Forbes & Hanley, 1850)—Janssen, 1984: 135, pl. 46 fig. 7.

Onoba proxima (Forbes & Hanley, 1850)—Martinell et al., 1984: 6, pl. 1 fig. 3.

Cingula (*Ceratia*) *proxima* (Alder, 1847 [sic])—González Delgado, 1986: 66, pl. 1 figs 1, 2.

Ceratia proxima Forbes & Hanley, 1850 [sic]—Graham, 1988: 208, fig. 79.

Ceratia proxima (Forbes & Hanley, 1850)—Bouchet & Warén, 1993: 703, figs 1655, 1656.

Ceratia proxima (Forbes & Hanley, 1850 ex Alder)—Cachia et al., 1996: 77, pl. 6 fig. 15.

Ceratia proxima (Forbes & Hanley, 1850)—Marquet, 1997: 20, pl. 4 fig. 6.

Ceratia proxima (Forbes & Hanley, 1850)—Marquet, 1998: 72, fig. 47.

Ceratia proxima (Forbes & Hanley, 1850 ex Alder ms.)—Giannuzzi-Savelli et al., 1996: 16, 124 fig. 548.

Ceratia proxima (Forbes & Hanley, 1850)—Wienrich, 2001: 410, pl. 66 fig. 8.

Ceratia proxima (Forbes & Hanley, 1850)—Ceregato & Tabanelli, 2005: 8, fig. 2.

Ceratia proxima (Forbes & Hanley, 1850)—Chirli, 2006: 70, pl. 29 figs 4–6.

Ceratia proxima (Forbes & Hanley, 1850)—Moths et al., 2010: 42, pl. 12 fig. 10.

Ceratia proxima (Forbes & Hanley, 1850 ex Alder m.s.)—Brunetti & Vecchi, 2014: 84, fig. 7.

Material and dimensions. NHMW2022/0070/0002, height 3.7 mm, width 1.5 mm (EL 1).

Discussion. This species is characterised by its truncated apex and fine spiral sculpture covering the entire teleoconch. It is widely distributed geographically and stratigraphically, but in the Middle and Upper Miocene of north-western France the genus is represented by *Ceratia ligeriana* (Peyrot, 1938) [= *Cingula* (*Ceratia*) *falunica* Glibert, 1949] that differs in lacking traces of spiral sculpture (for further discussion see Van Dingenen et al., 2016: 146). *Ceratia pliocenica* Ceregato & Tabanelli, 2005 from the Upper Pliocene Piacenzian of Italy differs in having a wider apical angle and the presence of microsculpture on the protoconch, which is smooth in *C. proxima* (Forbes & Hanley, 1850).

Distribution. Lower-Middle Miocene: North Sea Basin, Germany (Anderson, 1960; Wienrich, 2001; Moths et al., 2010), Breda Formation, the Netherlands (Janssen, 1984).

Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1874; Harmer, 1923), Kattendijk Formation (Marquet, 1998); Atlantic, Guadalquivir Basin, north-western Spain (González Delgado, 1986); central Mediterranean, Italy (Chirli, 2006). Upper Pliocene: North Sea Basin, Oorderen Sands (Marquet, 1998); western Mediterranean, Estepona Basin, Spain (this paper), north-eastern Spain (Martinell et al., 1984; Martinell & Domènech, 1984). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Cossmann, 1921; Pelosio, 1960; Caldara et al., 1981; Brunetti & Vecchi, 2014). Pleistocene (indet.): North Sea Basin, Scotland (Harmer, 1923). Present-day: Atlantic, British Isles (Fretter & Graham, 1978; Graham, 1988; Bouchet & Warén, 1993), Scandinavia (Bouchet & Warén, 1993); central Mediterranean (Cachia et al., 1996; Giannuzzi-Savelli et al., 1997). Does not extend southwards to Canary Islands (Hernández et al., 2011: 149).

Genus *Hyalia* H. Adams & A. Adams, 1852

Hyalia H. Adams & A. Adams, 1852: 359. Type species (by monotypy): *Turbo vitreus* Montagu, 1803, present-day, British Isles.

Hyalia vitrea (Montagu, 1803)

Figure 16a, b

Turbo vitreus Montagu, 1803: 321.

Hyalia vitrea (Montagu, 1803)—Cachia et al., 1996: 77, pl. 6 fig. 16.

Hyalia vitrea (Montagu, 1803)—Sosso & Dell'Angelo, 2010: 22, 33 unnumbered fig. top right.

Hyalia vitrea (Montagu, 1803)—Landau et al., 2013: 78, pl. 7 fig. 4, pl. 59 fig. 15 (cum syn.).

Hyalia vitrea (Montagu, 1803)—Brunetti & Vecchi, 2014: 85, fig. 7.

Hyalia vitrea (Montagu, 1803)—Brunetti & Cresti, 2018: 48, fig. 123.

Material and dimensions. NHMW2022/0070/0003, height 3.0 mm, width 1.2 mm (EL 1).

Discussion. Characteristic and widely distributed geographically and stratigraphically. However, this is the first record of the species in the Estepona assemblages. For discussion, see Landau et al. (2013: 78)

Distribution. Middle Miocene: Paratethys (Langhian-Serravallian): Poland (Bałuk, 1975), Hungary (Kókay, 1966); Proto-Mediterranean Sea (Serravallian): Karaman Basin, Turkey (Landau et al., 2013). Upper Miocene: Atlantic (Tortonian): Cacela Basin, Portugal (Dollfus et al., 1903). Lower Pliocene: North Sea Basin, Coralline Crag, England (Wood, 1848); Atlantic, Guadalquivir Basin, north-western Spain (González Delgado, 1986; Landau et al., 2011); central Mediterranean, Italy (Pavia, 1976; Montefameglio et

al., 1979; Chirli, 2006; Brunetti & Cresti, 2018), Tunisia (Fekih, 1975). Upper Pliocene: Atlantic, Mondego Basin, Portugal (Silva, 2001); western Mediterranean, Estepona Basin, Spain (this paper), north-eastern Spain (Martinell & Domènech, 1984); central Mediterranean, Italy (Sacco, 1895b; Ruggieri & Curti, 1959; Ruggieri, 1982; Cavallo & Repetto, 1992; Ferrero et al., 1998; Baroncelli, 2001; Repetto & Lacroce 2004; Sosso & Dell'Angelo, 2010). Lower Pleistocene: central Mediterranean, Italy (Cerulli-Irelli, 1914; Dell'Angelo & Forli, 1995; Brunetti & Vecchi, 2014); eastern Mediterranean, Rhodes Island (Chirli & Linse, 2011). Present-day: Atlantic, British Isles (Fretter & Graham, 1978; Graham, 1988; Bouchet & Warén, 1993), Norway (Bouchet & Warén, 1993); central Mediterranean (Cachia et al., 1996; Giannuzzi-Savelli et al., 1997). Does not extend southwards to Canary Islands (Hernández et al., 2011: 149).

Genus *Rhombostoma* Seguenza, 1876

Rhombostoma Seguenza, 1876: 13. Type species (by subsequent designation, Sacco, 1892): *Eulima carmelae* Brugnone, 1873, Pliocene, Italy.

Eulimopsis Brugnone, 1880: 120. Type species (by monotypy): *Eulima carmelae* Brugnone, 1873, Pliocene, Italy. Junior objective synonym of *Rhombostoma* Seguenza, 1876.

Two species were included by Seguenza (1876: 13) in his genus *Rhombostoma*: *Eulima carmelae* Brugnone, 1873, and *Rhombostoma striata* Seguenza, 1876. Cossmann (1921: 204) fixed *R. striata* as the type species. Warén (1984: 68) considered *R. striata*, “impossible to recognize” and that *E. carmelae* thus “becomes the type species by monotypy”. Ponder (1984: 21) confirmed the position of the genus within the family Iravadiidae Thiele, 1924.

Rhombostoma carmelae (Brugnone, 1873)

Figure 17a, b

Eulima Carmelae Brugnone, 1873: 7, fig. 6.

Rhombostoma carmelae Brugnone—Seguenza, 1876: 14.

Eulimopsis Carmelae Brugn.—Brugnone, 1880: 120.

Hemisinus? miodertonensis Sacco, 1895b: 8, pl. 1 fig. 12.

Hemisinus miodertonensis Sacco, 1895—Ferrero Mortara et al., 1984: 209, pl. 38 fig. 1.

Rhombostoma carmelae (Brugnone, 1873)—Ponder, 1984: 44, fig. 13G, H.

Rhombostoma imperforatum (Sacco, 1892)—González Delgado, 1988: 118, pl. 1 figs 15, 16 (non Sacco, 1892).

Rhombostoma carmelae (Brugnone, 1873)—Palazzi, 1989: 176, figs 1, 2.

Rhombostoma carmelae (Brugnone, 1873)—Chirli, 2006: 73, pl. 29 figs 15, 16.

Rhombostoma carmelae (Brugnone, 1873)—Landau et al., 2011: 12, pl. 3 fig. 5.

Rhombostoma carmelae (Brugnone, 1873)—Brunetti & Cresti, 2018: 48, fig. 124.

Material and dimensions. NHMW2022/0070/0001, height 4.9 mm, width 1.6 mm (VS 1).

Discussion. Two closely similar species occur in the Mediterranean Pliocene: *Rhombostoma carmelae* (Brugnone, 1873) and *R. imperforatum* (Sacco, 1892). *Rhombostoma imperforatum* differs in having more convex whorls, a deeper suture, a less expanded outer lip, slightly less excavated columella, and most obviously spiral sculpture developed along the entire teleoconch, although in some specimens it can subobsolete. In *R. carmelae* sculpture is reduced to a few cords over the base.

Palazzi (1989) noted that the spiral sculpture in *P. carmelae* could extend over part of the teleoconch, although the adapical ½ of the whorl was always unsculptured, and argued that *Ondina imperforata* Sacco, 1892 was a synonym of *R. carmelae*. He erected *R. diabolicum* Palazzi, 1986 for the species with the thinner lip and less excavated columella. Chirli (2006: 74) considered *Ondina pliobliqua* Sacco, 1892 and *R. diabolicum* subjective synonyms of *R. imperforatum*, a position followed herein. Chirli (2006: 75) also considered *Cingula friedbergi* Bałuk, 1975 as synonym of *R. imperforatum*. We reserve judgement on this position until the Paratethyan material is revised.

Distribution. Upper Miocene: Tortonian, Proto-Mediterranean, Italy (Sacco, 1895b; Palazzi, 1989). Lower Pliocene: Atlantic, Guadalquivir Basin, north-western Spain (González Delgado, 1988; Landau et al., 2011); central Mediterranean, Italy (Palazzi, 1989; Chirli, 2006; Brunetti & Cresti, 2018). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (this paper); central Mediterranean, Italy (Ruggieri, 1982; Palazzi, 1989; Bogi & Cauli, 1998).

Discussion

Six new species were added all described from a single shell: *Skenea gofasi* spec. nov., *Papuliscala spinosa* spec. nov., *Narrimania saldubensis* spec. nov., *Ophieulima lobilloensis* spec. nov., *Talassia plioalboranensis* spec. nov., and *Specula estebunensis* spec. nov. Despite the paucity of specimens, all new species are clearly new to science, their morphological features may be wider than described herein and a revision of the new species would be desirable once more material is available. However, most species can be distinguished on the basis of the morphological features of the protoconchs; these are expected to be more stable than the teleoconch features.

The two newly described epitoniids were probably feeding on anthozoans; the new eulimid probably fed on a species of Echinodermata and the new cerithiopsid was probably a spongivore; the new skeneid was probably a detritivore. The combination of genera suggests a deep-water

habitat with some firm substrate (rock, shell, or coral rubble) supporting various invertebrates that form food for the new gastropods.

As discussed in the introduction, the Estepona assemblages are exceptionally diverse, with both shallow and deeper water taxa represented. A full synthesis is planned at the end of the taxonomic series.

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Table 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 (Landau et al., 2011: 49, text fig. 8). For stratigraphic distribution black signifies Atlantic distribution (A), grey Mediterranean distribution (M).

| Species | Geographical distribution | | | | | Stratigraphical distribution | | | | | | | | | |
|---|---------------------------|---|---|---|-----|------------------------------|--------|----------|-------|-------------|-------|-----|-------|--|--|
| | Present-day | | | | | Miocene | | Pliocene | | Pleistocene | | Hol | | | |
| | 1 | 2 | 3 | 4 | a/b | Lower | Middle | Upper | Lower | Upper | Lower | | Upper | | |
| <i>Skenea dautzenbergi</i> (Glibert, 1949) | | | ● | ● | Ⓜ | | | | | | | | | | |
| <i>Skenea gofasi</i> spec. nov. | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Skeneoides exilissima</i> (Philippi, 1844) | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Mareleptopoma minor</i> (Almera & Bofill, 1898) | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Eatonina ochroleuca</i> (Brusina, 1869) | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Eatonina pumila</i> (Monterosato, 1884) | | | ● | ● | Ⓜ | | | | | | | | | | |
| <i>Papuliscala spinosa</i> spec. nov. | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Narrimania saldubensis</i> spec. nov. | | | | | Ⓜ | | | | | | | | | | |
| <i>Aclis cellinii</i> Chirli, 2009 | | | | | Ⓜ | | | | | | | | | | |
| <i>Aclis minor</i> (T. Brown, 1827) | ● | | ● | ● | Ⓜ | | | | | | | | | | |
| <i>Ophieulima lobilloensis</i> spec. nov. | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Talassia plioalboranensis</i> spec. nov. | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Specula estebbenensis</i> spec. nov. | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Seila trilineata trilineata</i> (Philippi, 1836) | | | | ● | Ⓜ | | | | | | | | | | |
| <i>Ceratia proxima</i> (Forbes & Hanley, 1850) | ● | | ● | ● | Ⓜ | | | | | | | | | | |
| <i>Hyala vitrea</i> (Montagu, 1803) | ● | | ● | ● | Ⓜ | | | | | | | | | | |
| <i>Rhombostoma carmelae</i> (Brugnone, 1873) | | | ● | ● | Ⓜ | | | | | | | | | | |

los depósitos pliocenos de la cuenca de Estepona (Málaga, S de España). Implicaciones paleobiogeográficas y paleoceanográficas. — Spanish Journal of Palaeontology 20 (2): 225–244.

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