

Additions to the gastropods of the middle Miocene (Serravallian) Karaman Basin, Turkey

Bernard M. Landau^{1,5}, Mathias Harzhauser², Yeşim Büyükmeriç³ & Anton Breitenberger⁴

¹ Naturalis Biodiversity Center, P. O. Box 9517, NL-2300 RA Leiden, ' e Netherlands; Centro de Geologia da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal, and International Health Centres, Av. Infante de Henrique 7, Areias São João, P-8200-261 Albufeira, Portugal, bernielandau@sapo.pt

² Naturhistorisches Museum Wien, Burgring 7, 1010 Vienna, Austria; mathias.harzhauser@nhm-wien.ac.at

³ Bülent Ecevit University, Engineering Faculty, Geological Engineering Department, 67100-Zonguldak, Turkey.

⁴ Florastraße 8, 2540 Bad Vöslau, Austria; breitenberger@gmail.com

⁵ Corresponding author

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Additions are made to the middle Miocene late Serravallian gastropod assemblage found in the Karaman Basin of Turkey. One new species is described: *Fusinus clavilithoides* nov. sp. *Buccinum duplicatum* Sowerby in Sedgwick & Murchison, 1832 is a junior homonym of *B. duplicatum* Linnaeus, 1758, *Buccinum (Cominella) hoellesense* Handmann, 1883 is the next available name for the fossil species. *Murex veranyi* Paulucci, 1866 is considered a junior subjective synonym of *Murex cyclopterus* Millet, 1865, not Millet, 1854, which is a *nomen nudum*.

KEY WORDS: Middle Miocene, Serravallian, Karaman Basin, Turkey, Gastropoda, systematics, new species

Introduction

Subsequent to the publication of the monograph on the gastropods of the middle Miocene (Serravallian) Karaman Basin, Turkey (Landau *et al.*, 2013) a few further species have come to light that deserve mention. In this paper we add four species to the fauna known from the Karaman assemblage.

Geological setting and Material and methods (see Landau *et al.*, 2013).

Locality 13 – South of Akpınar-Pınarlar Yaylası.

Locality 17 and 17a – Fields south of Seyithasan from outskirts of village for 2.4 km, on the western side of the road to Ağaçyurdu.

For detailed locality information see Landau *et al.* (2013).

Systematic palaeontology

Superfamily Buccinoidea Rafinesque, 1815

Family Nassariidae Iredale 1916 (1835)

Subfamily Dorsaninae Cossmann, 1901

Genus *Dorsanum* Gray, 1847

Type species (by original designation) – *Buccinum politum* Lamarck, 1822 (= *Buccinum miran* Bruguière, 1789), present-day, West Africa.

1847 *Dorsanum* Gray, p. 149.

1939 *Duplicatula* Kolesnikov, p. 703. Type species (by original designation): *Buccinum verneuilii* d'Orbigny in Hommaire de Hell, 1844, Miocene, Paratethys.

1955 *Duplicata* Korobkov, p. 363. Type species (by original designation): *Buccinum duplicatum* J. de C. Sowerby, 1832, Miocene, Paratethys.

Note – Harzhauser & Kowalke (2004) placed a number of Paratethyan Miocene species in the genus *Duplicata* Zhizhchenko in Kolesnikov, 1939. This was a *lapsus* for *Duplicatula*, which was synonymised by Galindo *et al.* (2016) with *Dorsanum*.

Dorsanum cf. *hoellesense* (Handmann, 1883)

Plate 1, fig. 1

cf. 1832 *Buccinum duplicatum* Sowerby in Sedgwick & Murchison, p. 420, pl. 39, fig. 14 (*non* Linnaeus, 1758).

cf. 1883 *Buccinum (Cominella) Höllesense* Handmann, p. 166.

cf. 1883 *Buccinum nodulosum* Handmann, p. 167 (*non* Gmelin, 1791).

cf. 2004 *Duplicata duplicata* (Sowerby, 1832) – Harzhauser & Kowalke, p. 34, pl. 5, figs 5-10, pl. 7, figs 11-12 (*cum syn.*).

Dimensions and material – Locality 17a: NHMW 2016/0102/0001 (Pl. 1, fig. 1), height 10.9 mm, width 5.0 mm.

Description – Shell small, bucciniform, moderately slender, surface glossy. Protoconch small, paucispiral, of 1.5 smooth whorls with large nucleus. Teleoconch of six whorls. First whorl with narrow, concave subsutural collar, sculptured by close-set ribs below collar, crossed by weak spiral threads. Abapically, collar broadens, axial ribs become wider spaced, developed only below collar, spiral sculpture rapidly weakens, absent from fourth teleoconch whorl. Last whorl not greatly inflated, ribs weakly nodulose at shoulder. Aperture pyriform, anal canal marked by groove, outer lip simple, bearing two denticles within placed mid-aperture. Parietal callus moderately developed. Siphonal fasciole flattened, bordered by a prominent, glossy, oblique cord, with a sharp edge delimiting it from the base.

Discussion – A single shell from the brackish beds at Seyithasan is attributed with ease to the genus *Dorsanum*. It is most similar to *Dorsanum duplicatum* (J. de C. Sowerby, 1832) especially in the character of the prominent cord bordering the siphonal fasciole and separating it sharply from the base of the last whorl. This cord and the absence of spiral cords on the base allow also a separation from the early Miocene *Dorsanum aquense* (Grateloup, 1845).

Dorsanum duplicatum (J. de C. Sowerby, 1832) was described from the Sarmatian (Middle Miocene) of Styria as *Buccinum duplicatum*. Unfortunately, *Buccinum duplicatum* J. de C. Sowerby, 1832 is a primary homonym of *Buccinum duplicatum* Linnaeus, 1758 (now classified at *Duplicaria duplicata*). The next available names are *Buccinum hoellessense* Handmann, 1883 and *Buccinum nodulosum* Handmann, 1883, which were established by Handmann (1883) for two morphotypes of *Buccinum duplicatum* J. de C. Sowerby, 1832. The rich topotypic material from Hölles (Austria) clearly documents that all specimens belong to a single variable species. As *Buccinum nodulosum* Handmann, 1883 is a primary homonym of *Buccinum nodulosum* Gmelin, 1791 (= *Casmaria ponderosa* Gmelin, 1791), as First Revisers we give precedence to the name *Buccinum hoellessense* Handmann, 1883 over the name *Buccinum nodulosum* Handmann, 1883, and use *Dorsanum hoellessense* as the valid name for this species.

The Turkish shell is more slender than most specimens of *Dorsanum hoellessense* (although this feature is variable; see Harzhauser & Kowalke, 2004, pl. 5, figs 5-10 and Švagrovský, 1971, pl. 67, figs 5-7) and no tubercles are formed on the subsutural collar. The axial ribs are only very slightly nodular at the shoulder, much less so than fully grown specimens of *D. hoellessense* from the

Paratethys. The small size of the Karaman shell suggests the shell may be subadult and not yet developed strongly nodular sculpture. The paucispiral protoconch is similar to that described and figured by Harzhauser & Kowalke (2004, pl. 7, figs 11-12) for *D. hoellessense*. We await further material to definitively identify this shell.

Distribution – Middle Miocene: Proto-Mediterranean (Serravallian), Karaman Basin, Turkey (this paper).

Subfamily Nassariidae Iredale 1916 (1835)

Note – We draw attention to an important paper by Galindo *et al.* (2016) on nassariid phylogeny, which showed that shell characters fail to accurately define supraspecific taxa within Nassariinae. They suggested that all the European and West African species should be placed under *Tritia* Risso, 1826 (type species *Buccinum reticulatum* Linnaeus, 1758, present-day, Europe), although surprisingly some southern Australian and New Zealand species also fit within the *Tritia* molecular clade. They also recognised the genus *Naytia* H. & A. Adams in West Africa (type species *Strombus glabratus* G.B. Sowerby II, 1842, present-day, West Africa). The western Atlantic and eastern Pacific species should be placed in *Phrontis* H. & A. Adams, 1853 (type species *Buccinum tiarula* Kiener, 1841, present-day, Pacific coast of America). The genus *Nassarius* Duméril, 1805 (type species *Buccinum arcularia* Linnaeus, 1758, present-day, Indo-Pacific) was considered strictly Indo-Pacific, together with the genus *Reticunassa* Iredale, 1936 (type species, *Nassa paupera* Gould, 1850, present day, Indo-Pacific). Therefore, all the species described and discussed by Landau *et al.* (2013, p. 172-186) under the genera *Nassarius* and *Naytiopsis* Thiele, 1929 should be reassigned to *Tritia*.

Family Fascioliariidae Gray, 1853

Subfamily Fusininae Wrigley, 1927

Genus *Fusinus* Rafinesque, 1815

Type species (by typification of replaced name) – *Murex colus* Linnaeus, 1758, present-day, Pacific.

- 1789 *Fusus* Bruguière, p. xv. Junior homonym of *Fusus* Helbling, 1779. Placed on the Official Index by Opinion 1765 [(Petit & Wilson) 1994, p. 159].
- 1815 *Fusinus* Rafinesque, p. 145.
- 1843 *Cyrtulus* Hinds, p. 256. Type species (by monotypy): *Cyrtulus serotinus* Hinds, 1843, present-day, Marquesas Islands.
- 1909 *Fusinus* (*Barbarofusus*) Grabau & Shimer, p. 775. Type species (by original designation): *Fusus barbarensis* Trask, 1855, Pleistocene to present-day, Indo-Pacific.

***Fusinus clavilithoides* nov. sp.**

Plate 1, fig. 2

Type material – Holotype NHMW 2016/0102/0002 (Pl. 1, fig. 2), height 81.3 mm, width 29.9 mm.

Etymology – Name reflecting the appearance similar to species of the genus *Clavilithes*. *Fusinus* gender masculine.

Locus typicus – Locality 13, Pınarlar Yaylası, Akpınar, Karaman Basin, Karaman Province, Turkey.

Stratum typicum – Tirtar Formation, Serravallian, middle Miocene.

Diagnosis – A *Fusinus* species of medium size, robust, with a tall, regularly conical spire, sculpture restricted to early teleoconch whorls, composed of eight broad axial ribs crossed by three spiral cords, the later whorls smooth, a barrel-shaped last whorl, angled at base, which is concave, a long, open siphonal canal and a flattened siphonal fasciole with a deep umbilical chink.

Description – Shell medium to large sized, fusiform, solid, with relatively tall conical spire. Protoconch abraded. Teleoconch of ten whorls separated by impressed suture. Early whorls straight-sided, with periphery at abapical suture, bearing sculpture of about eight broad axial ribs, equal in width to their interspaces, crossed by three broad spiral cords, equal in width to their interspaces. Abapically sculpture rapidly weakens, so that sixth whorl surface smooth, except for inconspicuous axial growth lines. Whorls become weakly convex, slightly swollen abapically, with periphery just above suture. Last whorl barrel-shaped, with straight sided to weakly concave subsutural ramp, weakly convex below shoulder, subangular at base. Base concave, delimited adapically by angulation, not delimited from siphonal fasciole. Aperture ovate, outer lip edge damaged, obscurely lirate within, bearing single elongated tooth at junction with siphonal canal. Siphonal canal open, long, narrow, posteriorly recurved. Columella regularly excavated, bearing single narrow fold at junction with siphonal canal, placed opposite tooth on outer lip. Columellar callus thickened, sharply delimited, adherent, weakly expanded, with small parietal pad adapically, Siphonal fasciole flattened, recurved forming lateral border of conspicuous, deep umbilical chink.

Discussion – The generic placement of this species is problematic. Our first reaction was that it represented a species of the subfamily Peristerniinae Tryon, 1880. It is not unlike some members of the present-day Caribbean genus *Bullockus* Lyons & Snyder, 2008 such as *B. mcmurrayi* (Clench & Aguayo, 1941). Indeed, one fossil species from the Miocene of Italy has a similar shell shape, *Turbinella crassicosta* Michelotti, 1847. [Note: Michelotti's original description gives the shell height as 7 mm. This would be unusually small for this group

of shells and is probably an error. Bellardi (1884, p. 24, pl. 1, figs 17, 18) figured two specimens, height 81 and 45 mm respectively. Of the sizes quoted in the text, only one matches fig. 18, nevertheless, Bellardi's dimensions of 31-81 mm are more in keeping with shells of the genus and more likely to give the correct size range for this species]. However all Peristerniinae have columellar folds, whereas no folds can be seen or felt on or within the columella. These are also seen in the illustration of Michelotti (1847, pl. 8, fig. 6). In order to make sure columellar folds were not present on the early whorls, an Xray (Pl. 1, fig. 2d) and CT scan (Pl. 1, fig. 2e) were performed, which confirmed their absence.

The general shape of the shell, with its tall, regularly conical spire and sculpture that becomes rapidly obsolescent is reminiscent of some species in the '*Clavilithes*' group. *Clavilithes* Swainson, 1840 also has columellar folds (Snyder, 1999), but *Clavellofusinus* Grabau, 1904 species have a smooth columella. Indeed *Clavellofusinus britannicus* (Wrigley, 1927) from the Eocene of England has a similar shell shape and sculpture. However, *Clavellofusinus* is an almost exclusively Eocene genus. The only Miocene species included by Snyder (1999) in the genus is *Fusus (Clavella) fennemai* Martin in Martin & Icke, 1906. We have a complete specimen of *F. (C.) fennemai* at hand from the middle Miocene Nyalindung Formation of West Java (NHMW coll.). Although clearly not conspecific with the shell from Turkey, they share the same general shape, solid shell, sculpture which disappears on later teleoconch whorls, an angled concave base, a smooth columella and a broad siphonal fasciole that forms a deep umbilical chink.

There is also an extant genus that bears a general resemblance to the Turkish species, the genus *Cyrtulus* Hinds, 1843, with monotype *C. serotinus* Hinds, 1843, from present-day Marquesas Islands, Polynesia. This was included by Snyder (1999) in the genera closely related to *Clavilithes*. *Cyrtulus serotinus* has a strange shell, with a spire indistinguishable from that of many fusinid species, but an abrupt change of sculpture and growth rate on the penultimate whorl leading to a thickened '*Clavilithes*'-like last whorl. We see greater similarity between *F. (C.) fennemai* and *Cyrtulus serotinus* than we do between the Indonesian species and the European Eocene *Clavellofusinus* group.

Therefore, we consider this new Turkish species to be most closely similar to *Cyrtulus*. However, the recent molecular phylogenetic study on the Fasciolaridae performed by Couto *et al.* (2016) showed that *Cyrtulus serotinus* nested within *Fusinus* Rafinesque, 1815 and was a sister species to *F. longissimus* (Gmelin, 1791), although this species has a conservative fusinid-shaped shell. Therefore it seems that these species, *Cyrtulus serotinus*, *F. (C.) fennemai* and the new Turkish species are all highly derived *Fusinus* species. There is no European present-day or fossil species with which *Fusinus clavilithoides* nov. sp. can be compared.

Distribution – Middle Miocene: Proto-Mediterranean, Karaman Basin, Turkey (this paper).

Superfamily Muricoidea Rafinesque, 1815
 Family Muricidae Rafinesque, 1815
 Subfamily Muricinae Rafinesque, 1815
 Genus *Purpurellus* Jousseume, 1880

Type species (by original designation) – *Murex gambien-sis* Reeve, 1845, present-day, West Africa.

1880 *Purpurellus* Jousseume, p. 335.

***Purpurellus cyclopterus* (Millet, 1865)**

Plate 1, fig. 3

- 1854 *Murex cyclopterus* Millet, p. 162 (*nomen nudum*).
 *1865 *Murex cyclopterus* Millet, p. 592.
 1866 *Murex Veranyi* Paulucci, p. 64, pl. 2, fig. 1, pl. 3, fig. 1.
 1875 *Murex (Pterynotus) cyclopterus* Millet – Tournouër, p. 147, pl. 5, fig. 2.
 1995 *Pterynotus (Purpurellus) cyclopterus* (Millet, 1866) – Bałuk, p. 216, pl. 22, figs 9-11.
 2000 *Pterynotus veranyi* (Paulucci [sic], 1866) – Chirli, p. 18, pl. 9, figs 4-10.
 2006 *Pterynotus (Purpurellus) cyclopterus* (Millet, 1866) – Bałuk, p. 207, pl. 11, fig. 5.
 2007 *Purpurellus veranyi* (Paulucci, 1866) – Landau *et al.*, p. 18, text-fig. 4, pl. 4, figs 3-5, pl. 5, figs 1-5 (*cum syn*).
 2011 *Purpurellus veranyi* (Paulucci, 1866) – Merle *et al.*, p. 142, pl. 118, figs 3-9.
 2013 *Purpurellus veranyi* (Paulucci, 1866) – Goret *et al.*, p. 10, pl. 2, fig. 6.

Dimensions and material – Locality 17: NHMW 2016/0102/0003 (Pl. 1, fig. 3), height 35.7 mm, width 19.7 mm.

Discussion – As discussed by Landau *et al.* (2016), the correct date for Millet's 'Indicateur du Maine-et-Loire ou indications par commune de ce que chacune d'elles renferme. Tome 2. Angers' is 1865. The 1866 reference is a reprint of the 1865 palaeontology section. Therefore, *Murex cyclopterus* Millet, 1865 must take priority over the more often used name *Murex veranyi* Paulucci, 1866. We can also not apply Article 23.9.1.2 (ICZN 1999) to consider Millet's name a *nomen oblitum*, as Tournouër (1875), Cossmann & Peyrot (1924) and Bałuk (1995) all used Millet's name as the valid name of a taxon. *Purpurellus cyclopterus* (Millet, 1865) is represented in the Karaman assemblages by a single, well preserved adult specimen. This species is remarkably long-lived and widely distributed, although uncommon in all assemblages. For further discussion see Landau *et al.*, (2007, p. 19).

Distribution – Lower Miocene: Atlantic, Aquitaine Basin, France (Landau *et al.*, 2007; Merle *et al.*, 2011). Middle Miocene: Atlantic (Langhian), Loire Basin (Tournouër, 1875; Glibert, 1952; Merle *et al.*, 2011), Aquitaine Basin, France (Cossmann & Peyrot, 1924); Proto-Medi-

terranean (Langhian and Serravallian), Italy (Bellardi, 1873), Karaman Basin, Turkey (this paper); Paratethys, Poland (Bałuk, 1995), Romania (NHMW). Upper Miocene: Atlantic (Tortonian), north western France (Millet, 1865; Tournouër, 1875; Merle *et al.*, 2011), Cabela, Portugal (Pereira da Costa, 1867); Proto-Mediterranean: Italy (Bellardi, 1873; Sacco, 1904; Montanaro, 1935). Lower Pliocene: western Mediterranean, France (Goret *et al.*, 2013; central Mediterranean (Chirli, 2000). Upper Pliocene: western Mediterranean, Estepona Basin, Spain (Muñiz-Solis & Guerra-Merchán, 1994); central Mediterranean, Italy (Ruggieri *et al.*, 1959; Malatesta, 1974; Cavallo & Repetto, 1992; Andreoli & Marsigli, 1992).

Family Ocenebrinae Cossmann, 1903

Genus *Ocenebra* Gray, 1847

Type species (by monotypy) – *Murex erinaceus* Linnaeus, 1758, present-day, northeastern Atlantic, Mediterranean.

- 1828 *Tritonalia* Fleming, p. 564. Type species (by subsequent designation; Gray, 1847): *Murex erinaceus* Linnaeus, 1758, present-day, northeastern Atlantic, Mediterranean. Placed on the Official Index by ICZN (1969; Opinion 886).
 1847 *Ocenebra* Gray, p. 269.

***Ocenebra vindobonensis vindobonensis* (Hörnes, 1853)**

Plate 1, fig. 4

- *1853 *Murex Vindobonensis* Hörnes, p. 252, pl. 25, fig. 17.
 1966 *Tritonalia vindobonensis* (Hörnes) var. – Kokay, p. 57, pl. 8, fig. 6.
 1995 *Purpura (Tritonalia) vindobonensis* (Hörnes, 1856 [sic]) – Bałuk, p. 227, pl. 30, fig. 5.
 2002 *Purpura (Tritonalia) vindobonensis* (Hörnes, 1856 [sic]) – Harzhauser, p. 97, pl. 6, figs 13-14.
 2006 *Purpura (Tritonalia) vindobonensis* (Hörnes, 1856 [sic]) – Bałuk, p. 209, pl. 13, figs 4-8.
 2013 *Ocenebrina* sp. – Landau *et al.*, p. 153, pl. 22, fig. 12.
 2013 *Ocenebra vindobonensis* (Hörnes, 1856 [sic]) – Goret & Pons, p. 61, text-fig 5/2, pl. 4, fig. 2.

Dimensions and material – Maximum height 28.1 mm. Localities 2 & 3: NHMW 1847/0058/1441 (1); locality 17: NHMW 2016/0102/0004 (Pl. 1, fig. 4), YI 193/1 + 1 incomplete specimen.

Discussion – Landau *et al.* (2013, p. 153, pl. 22, fig. 12) ascribed their juvenile shell to the genus *Ocenebrina* Jousseume, 1880, but the adult illustrated here places the shell in the genus *Ocenebra* and the species to *O. vindobonensis* (Hörnes, 1853). Vermeij & Vokes (1997, p. 72) restricted the genus *Ocenebra* to "a relatively small number of Miocene to present-day species from western Europe, the Mediterranean region and Tropical West

Africa. These are characterized by the tendency to form three varices on the last whorl, by the presence of six to eight primary spiral cords on the last whorl, a crenulated outer lip without a labral tooth, an adherent or very lightly erect inner lip, and six weak to strong denticles on the inner side of the outer lip. In species with varices, the latter are separated from each other by a single intervarical node. *O. vindobonensis* fits well within this generic description.

Goret & Pons (2013) recorded the species from the slightly older upper Burdigalian-lower Langhian western Proto-Mediterranean (France). Both Glibert (1952, p. 307) and Goret & Pons (2013, p. 61) discussed the differences between *O. v. vindobonensis* and *O. vindobonensis ligeriana* (Tournouër, 1875), described from the Atlantic Middle Miocene of France, and noted that these differences were minor. Glibert (1952) also noted a strong intraspecific variability amongst specimens of *O. vindobonensis ligeriana* from the Loire Basin. The adult shell from Karaman has a tall spire; like Paratethyan *O. v. vindobonensis* and the shell illustrated by Goret & Pons (2013, text-fig 1/2). The intervarical node is nodular and less elongate than it is in *O. vindobonensis ligeriana*. The primary cords are not particularly strongly developed and do not form the digitations seen in specimens at hand from Bad Vöslau, Austria (NHMW coll.), similar to those figured by Hörnes (1853, pl. 25, fig. 17), nor the strong crenulation at the thick outer lip seen in *O. vindobonensis ligeriana*. Based on material seen from Ferrière Larçon (Loire Basin), Karaman and Austria, we agree with previous authors in separating the lower and middle Miocene Paratethyan and Proto-Mediterranean form from the middle Miocene Atlantic form. *Ocenebra vindobonensis ligeriana* has 1) a slightly higher spire, 2) a more angular shoulder, 3) an elongated rib-like rather than tubercular intervarical node and 4) a thicker, more strongly crenulated labial varix. We consider *O. vindobonensis ligeriana* a geographically isolated Atlantic subspecies. The shell illustrated by Goret & Pons (2013, text-fig 5/1) as *Ocenebra cf. vindobonensis* (Hörnes, 1856 [*sic*]) from the Atlantic Aquitanian Lower Miocene of Saint-Martin-d'Oney (Landes, France) certainly belongs within the same species group, but differs in having an intervarical rib rather than tubercles. The tall spire and disposition and shape of the spiral cords are more similar to *O. vindobonensis s.str.* than to the *ligeriana* subspecies. This

may be the earliest member of the group giving rise to the forms described above.

Distribution – Lower Miocene: Paratethys (Burdigalian), Austria (Harzhauser, 2002). Lower-Middle Miocene: Proto-Mediterranean (upper Burdigalian-lower Langhian), France (Goret & Pons, 2013). Middle Miocene: Proto-Mediterranean, Karaman Basin, Turkey (Landau *et al.*, 2013; this paper); Paratethys, Austria (Hörnes, 1853), Poland (Bałuk, 1995), Hungary (Kokay, 1966).

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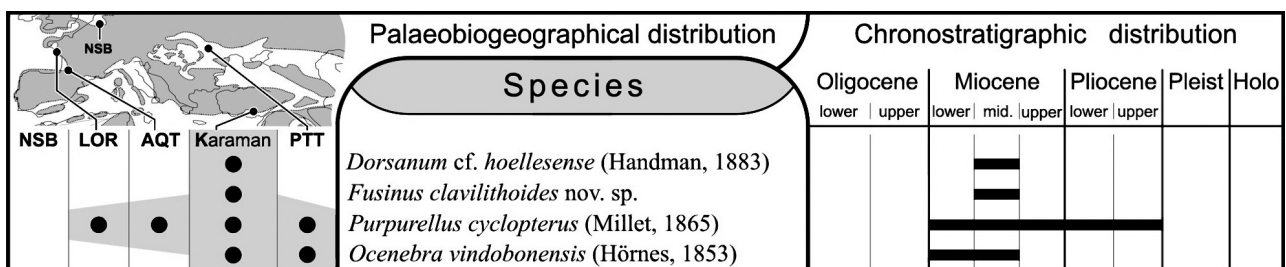


Table 1: Palaeogeographical and geochronological distributions of the species identified in the middle Miocene Karaman Basin gastropod assemblages. In the palaeobiogeographical distribution, black dots represent occurrences. NSB = North Sea Basin, LOR = Loire Basin, AQT = Aquitaine Basin, PTT = Paratethys.

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Plate 1

1. *Dorsanum* cf. *hoellesense* Handmann, 1883, NHMW 2016/0102/0001, height 10.9 mm, width 5.0 mm, locality 17a, brackish assemblage, Seyithasan.
2. *Fusinus clavilithoides* nov. sp., holotype NHMW 2016/0102/0002, height 81.3 mm, width 29.9 mm, locality 13, Pınarlar Yaylası, Akpınar.
3. *Purpurellus cyclopterus* (Millet, 1865), NHMW 2016/0102/0003, height 35.7 mm, width 19.7 mm, locality 17, Seyithasan.
4. *Ocenebra vindobonensis vindobonensis* (Hörnnes, 1853), NHMW 2016/0102/0004, height 28.1 mm, width 14.2 mm, locality 17, Seyithasan.

All: Karaman Basin, Karaman Province, Turkey, Tirtar Formation, Serravallian, middle Miocene.

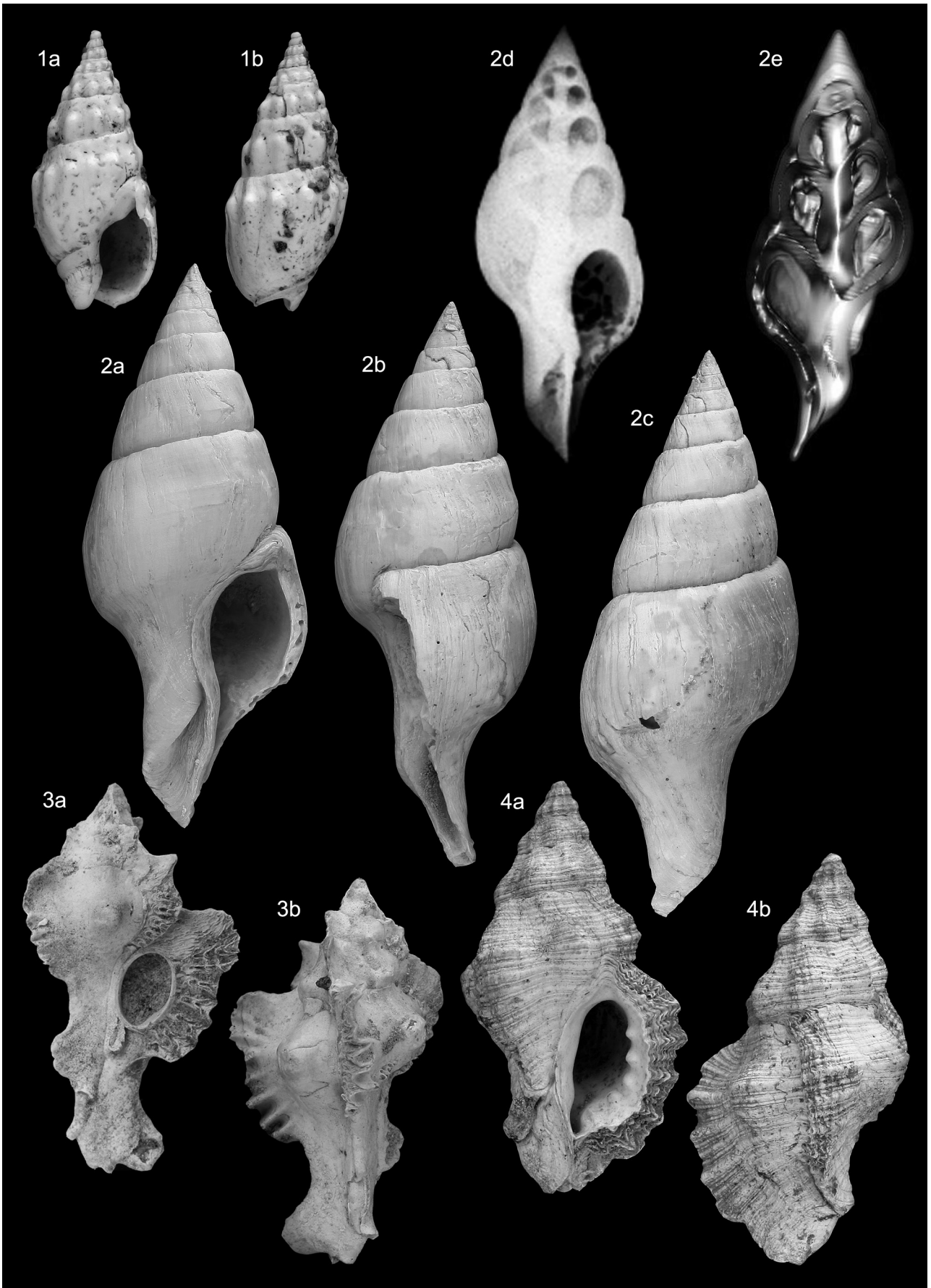


Plate 1